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REVISION OF THE NEARCTIC MYRMELEONIDAE.

BY NATHAN BANKS.

WITH FOUR PLATES.

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NO. 1.— *Revision of the Nearctic Myrmeleonidae.*

BY NATHAN BANKS.

THE Myrmeleonidæ or ant-lion flies are generally recognized among the Neuroptera by their slender, rather densely veined wings, the long body, and short, clavate antennæ. The habits of the larvæ of certain forms (particularly Myrmeleon) in digging pits to entrap wandering insects has given them their common and scientific names.

The Nearctic Myrmeleonidæ are chiefly a northward extension of the Neotropical fauna, thus Texas, New Mexico, and Arizona are the most favored states. Several of the genera as *Brachynemurus*, *Hesperoleon*, *Austroleon*, *Glenurus*, and *Psammoleon* are common in Central and South America, but do not occur in the Old World. The genus *Myrmeleon* occurs in all the continents, and is everywhere fairly common. *Dendroleon* does not occur south of the United States, but is represented in Europe and Asia, in the latter country with numerous species. It is more common in the eastern than the western states. *Hesperoleon* has but one or two species in the eastern states, but many in the western states.

The family, originally of but one genus, has undergone many changes, until now there are four subfamilies and nearly a dozen tribes. One of the subfamilies, the *Palparinae*, does not occur in America, and several tribes do not occur in the United States. The forking of the third anal vein I do not consider of tribal value; although usually quite constant there are species it would separate that are otherwise closely related, and in some species there are specimens with this vein forked in one wing and simple in the opposite wing. The absence of the small cross-veins in the apical field is also too inconstant to be even of generic value; specimens in which these are absent in only one wing are not unusual, and a fair series of any species will show variation in their number. Likewise the absence of spurs is not of tribal importance. The various genera lacking spurs show by their venation affinity to various tribes.

The origin of the radial sector in relation to the cubital fork I still consider of great importance, but for the Nearctic forms it is best used in connection with the course of the basal part of the second anal vein as indicated in the following tables. The character I used as of prime importance for African Myrmeleons, whether there is one (or two) cross-veins before the radial sector in the hind-wing or four (or more), cannot be used on American Myrmeleons, for in the group of *Brachy-*

nemurus, which usually has two or three such veins, there is sometimes only one and sometimes four or even five. It is necessary therefore to have recourse to the characters of the second anal vein. Once outside of the subfamily Dendroleoninae the number of cross-veins before the radial sector is as useful in American Myrmeleons as in those of the Old World.

The characters used in the classification of genera are mostly taken from the venation and legs. The palpi, antennae, pronotum, and abdomen are used to a less extent. The species are largely based on coloration, color and length of hair, length of spurs, minor venational points, and the male appendages. Most of the characters used are readily understood, being similar to those in other insects. There is in many species the appearance of a line through the middle of the wing toward the tip. This is produced by the bending of the branches of the radial sector; it has been termed (by Tillyard and Petersen) the Banksian or anterior Banksian line. A similar line in the cubital area is called the posterior Banksian line or intercubital line. In many of the Nearctic species these lines are hardly as useful as in Old World species. The small cross-veins in the apical field have been called gradate veins; they are of little value. Toward the outer part of the wing the median and cubital veins are connected rather more than in the rest of their courses, this is the rhagma, and there is frequently a dark spot on it, or a line up from it.

One Nearctic species was described by DeGeer, one by Drury, a few by Burmeister, Rambur, and Thomas Say. Hagen in 1861 in his Synopsis of North American Neuroptera, gave the first good account, describing twenty-five species, and later he added ten more. In recent years Mr. R. P. Currie and the writer have described several new species, while Navas has added four names, and McClendon one. One new genus, two new species, and a new variety are included in this account, a total of sixty-nine species, two varieties, and nineteen genera.

Doubtless a few more will be found in the West and in southern Texas. There are several species known from but one specimen. The genera, I think, have been divided enough, possibly it would be better to sink under *Brachynemurus* several of the related genera. Two of the species (*delicatulus* and *barberi*) I have not seen for some years and the original descriptions are given, supplemented by notes and drawings made ten years ago, together with some notes kindly furnished by Mr. S. A. Rohwer.

Navas has published two genera and four species as new from the United States. Neleon is a new genus for *Myrmeleon immaculatus*

DeGeer. This species is very close to the type of the genus in so many structural characters that if the genus is to be divided it surely will go with the genotype. The number of gradiform veinlets in the apical field is variable in this as well as in most, if not all, species of the family; the development of the plicate lines shows a gradation in the various species so that limitation is not possible. *Mastega* is a new genus; and *M. texanus*, a new species, is evidently a Cryptoleon. It is true that in *C. nebulosum* (the genotype) there are nearly always numerous costal cross-veins connected, but the number is variable; but in *C. signatum* there are usually only very few costals connected, and frequently none. With any sort of a series this character is too variable for generic importance here; in some genera the character is much more constant. As to the species *texanus*, it agrees generally with *C. signatum*, but is said to have the abdomen "fusco pilosum." This would ally it to *C. nebulosum*. I have seen no specimen of either species from Texas, and it is possible that *texanus* is a good species. The type is in the Vienna Museum.

Hesperoleon placidus is from New Jersey. This is a dark, strongly-marked specimen of *H. abdominalis* in which the pronotal stripes are extended forward. I have several such specimens from the east, and they grade into the normal form.

Hesperoleon nivatensis is from Nevada. By the infuscated mid- and hind-femora and the long male appendages this is *H. singularis* Currie. The amount of infuscation in the femora is variable, but they are not dotted.

Psammoleon serpentinus agrees with *P. sinuatus* Currie, but this serpentine line is not constant in this species nor peculiar to it.

Synopsis of the subfamilies.

1. In the fore-wings the second anal vein runs in a fairly even curve (Plate 2, fig. 41), and is connected to the third anal by a short cross-vein, or united to it for a short distance (Plate 2, fig. 40); the radial sector usually arises before the cubital fork; in hind-wings rarely four veins before the origin of the radial sector *Dendroleoninae*.
In the fore-wings the second anal vein runs up to and close beside the first anal (Plate 2, fig. 39, 45), then at an angle turns down and unites with the third anal for a distance; abdomen shorter than wings.....2
2. In the hind-wings but one (or rarely two) cross-veins before origin of the radial sector, latter point before the cubital fork. *Macronemurinae*.
In the hind-wings four (or more) cross-veins before radial sector, latter usually beyond fork of cubitus; antennae well separated at base.

Myrmeleoninae.

DENDROLEONINAE.

Of Nearctic forms this is the most primitive group, the venational characters being far less constant than in the two other subfamilies. The group is principally American, only a few forms are known in Europe and Asia, and possibly in South Africa, while several striking forms of the typical tribe occur in Australia.

There are two tribes separable as follows: —

1. In the fore-wings the cubital vein shows at base a distinct fork running out a short distance and then uniting with first anal (Plate 2, fig. 41); legs very slender, basal tarsal joint equal next two *Dendroleonini*.
In the fore-wings the cubital vein has no distinct fork at base, sometimes a faint trace; legs much less slender, basal tarsal joint rarely equal to next two joints united. *Brachynemurini*.

DENDROLEONINI.

The Dendroleonini has but one, the typical, Nearctic genus.

DENDROLEON Brauer.

Reise freg. Novara. Zool. theil., 1866, 2. Neur., p. 42.

Antennae rather long; pronotum longer than broad; legs very slender, femora cylindrical, tibia about as long as femur, basitarsus as long as fifth joint, spurs very long, but little curved, equal to more than two joints. Wings moderately broad, with large spots, a single costal series, in both wings the radial sector arises before the cubital fork, in hind-wing one cross-vein before radial sector, the first anal in hind-wing runs parallel to the hind-margin and into cubital fork, in fore-wing the second anal runs free of both first and third anals and connected to each by one or more cross-veins, basal fork of cubitus distinct. Banksian line fairly complete in both wings, no intercubital line; abdomen not as long as hind-wings. In the type and in Nearctic species in the hind-wing the third anal is separate from second, forked near tip, and there is a fourth anal closely parallel to hind-margin; in the exotic species the third is united to second at base, and the fourth is absent.

TYPE.— *D. pantherinum* (Fabricius). Europe.

DENDROLEON OBSOLETUM Say.

Plate 4, fig. 101.

Formicaleo obsoletus Say, Journ. Acad. nat. sci. Phil., 1839, 8, p. 44; Ed. Lec., 2, p. 413.

Dull yellowish gray or sordid. Interantennal mark brown, not much below nor above antennae vertex hardly darkened, sometimes a yellowish band below. Pronotum usually unmarked, sometimes median or lateral short, faint lines; rest of notum black in middle, pale on sides; pleura dark below, pale above; front- and mid-legs largely black, hind-femora black, pale at base, and a band before tip, tibia pale, a black line below, and base and tip dark; tarsi partly pale, spines slender, black, the front-tibiae are sometimes pale beneath near tip; abdomen black, sometimes showing pale spots in middle of some segments, hairs black, some white intermixed, not very long. Veins white and brown interrupted, often in streaks, spot at base of stigma, one behind, and one beyond, a long mark at rhagma, often broken into several long spots, an irregular mark at end of anal, often broken, and one beyond, and one before on the hind-margin, one at origin of radial sector, and two or three smaller spots beyond, usually several small spots along cubitus; hind-wings with mostly pale venation, some dark streaks, a large spot, larger than any in the fore-wing, over the last cross-veinlet from radial sector to radius before stigma, another more irregular near tip, and three or four small spots behind these, two of which are on the hind-margin.

In the fore-wings many of the costals are forked, about four cross-veins before radial sector, about eleven branches of radial sector, apical field with a few cross-veins, anal vein with about ten branches; in hind-wings one cross-vein before radial sector, radial sector about ten branched, anal vein with eight branches.

Length fore-wing 25 to 31 mm., width 7 to 8.8 mm.

Length hind-wing 25 to 31 mm., width 5 to 7 mm.

Length abdomen ♀ and ♂ 15 to 17 mm.

Specimens examined.—N. H.: Durham. Mass.: Sherborn; July; Tyngsboro. Conn.: New Milford. N. Y.: Ithaca, August. Md.: Travilah, July. Va.: Falls Church, July. N. C. (Morrison). Ill.: Galena. Mich.: Huron Co. Also Raleigh, N. C. (N. C. state coll.). Yaphank, N. Y. (Davis coll.). Florida (Slosson coll.).

DENDROLEON SPECIOSUM Banks.

Plate 2, fig. 41.

Trans. Amer. ent. soc., 1906, 32, p. 7.

This species may be compared to *D. obsoletum*. The interantennal mark is rather more prominent, the vertex darker, and with a white band in front; the median and lateral lines on pronotum are distinct; the front-part of the mesonotum is mostly pale in the middle; front- and mid-tibia mostly pale, and front-femora often pale below, the mid-femora with broad pale preapical band, hind-legs more pale, usually no line under tibia.

The spots on the wings are smaller and more numerous, beyond the much broken streak from the rhagma there are many spots on the fork which tend to make a row; the spot on hind-margin beyond the long curved mark at end of anal is also elongate (much longer than in *obsoletum*) and points to the tip of the anal mark. There is more dark in the venation, and many veinlets are more or less bordered. In the hind-wings the spots are also smaller and more numerous, and the venation largely dark (in *D. obsoletum* mostly pale), and many small clouds on forks toward margin.

In the fore-wing the costal area is more narrow, and the costals a little less numerous, so that these cells are not nearly as narrow as in *D. obsoletum*. The species is a little smaller than *obsoletum*.

Length fore-wing 22 to 29 mm., width 5.5 to 8 mm.

Length hind-wing 22 to 29 mm., width 4 to 6.5 mm.

Length abdomen ♀ and ♂ 12 to 15 mm.

Specimens examined.— Colo.: Boulder, July. (TYPE). N. M.: Jemez Mts., July. Ariz.: Palmerlee. Calif.: Modoc Co., July.

BRACHYNEMURINI.

1. In the hind-wing the first anal runs parallel to the cubital fork for some distance, and connected thereto by several cross-veins; Banksian lines usually evident. 2
- In the hind-wing the first anal bends down to margin near the forking of the cubitus, not running parallel to the cubital fork, and not connected thereto but once or twice; Banksian lines hardly distinct. 7
2. No spurs. *Cryptoleon*. 4
- Spurs present. 3
3. Costal area of fore-wing with two or three series of cells for about half-way or more. 4
- Costal area of fore-wing with but one series of cells, except sometimes near the stigma. 5

4. Cross-veins before radial sector in the fore-wing mostly connected; in our species three series of costal cells.....*Calinemurus*.
Few if any cross-veins before radial sector connected; two series of costal cells; front-coxae with macrochaetae.....*Brachynemurus*.
5. Labial palpi elongated, very much longer than the front-tarsi; spurs equal two tarsal joints; antennae rather widely separated.....*Scotoleon*.
Labial palpi not longer than front-tarsi.....6
6. Front-femur with a row of curved white bristles above as well as several on the front-coxa.....*Netroneurus*.
Front-femur without such bristles, sometimes one or two on the front-coxa.
Hesperoleon.
7. No spurs, basal tarsal joint longer than the fifth.....*Maracandula*.
Spurs present.....8
8. Front-coxa with several curved white bristles as well as a row on front-femur above, second and third anal veins of front-wings usually united at a point.....9
Front-coxa and front-femur without the comb of white macrochaetae; in fore-wing the cubitus often has its first cross-vein oblique as though it was a cubital fork.....*Clathroneuria*.
9. Legs very slender, front-tibia equal to front-femur; mesonotum with enlarged bristles above; abdomen shorter than hind-wings; antennae elongate; second and third anals in fore-wing forked.....*Chaetoleon*.
Legs not especially slender, front-tibia a little shorter than front-femur; mesonotum with only simple bristles above; abdomen about equal to or longer than hind-wings; antennae very short.....*Austroleon*.

CRYPTOLEON Banks.

Can. ent., 1901, 33, p. 330.

Last joint of labial palpi not distinctly swollen; antennae rather short, not strongly clavate; the pronotum rather broader than long in the middle; basal tarsal joint nearly as long as the next two united, no spurs; abdomen of male much longer than in female. Costal area of wings either one- or two-celled, showing much variation, Banksian line in fore-wing either faint or distinct, intercubital not definite; radial sector much before cubital fork, second anal running in even curve, connected to the third by a cross-vein, second usually simple, third forked. In hind-wings the radial sector usually before cubital fork, two cross-veins before it; first anal runs out parallel to the cubital fork for some distance and connected thereto by several cross-veins, second and third anals usually both forked.

TYPE.—*C. nebulosum* (*conspersus* (Rambur) (Olivier)).

The three Nearctic species are distinguished in the following table:

1. Front-wings with costal area largely biareolate, usually partly in hind-wings; pronotum with median pale mark only in front; wings heavily marked, usually some dark between subcosta and radius; hair on abdomen mostly black.....*nebulosum*.
 Front-wings with costal area mostly uniareolate; hind-wings always so; pronotum with a pale median stripe throughout; wings very lightly marked, no dark between subcosta and radius; hair on abdomen mostly white.....2
2. Front-femora dark on outer sides; wings very slender, median vein largely white; western.....*henshawi*.
 Front-femora mostly pale, dotted with dark; wings broader, median vein largely dark; eastern.....*signatum*.

CRYPTOLEON NEBULOSUM (Olivier).

Plate 3, fig. 49, 56.

Myrmeleon nebulosum Olivier, Encycl. meth., 1811, 8, p. 127.

Interantennal mark somewhat above and below antennae, often including a pale median dot between antennae; vertex dark brown or black; palpi marked with brown; pronotum dark, three pale spots in front-part, the median one linear and behind on each side is a pale streak; rest of notum mostly black, a few pale spots, scutelli pale each side behind; pleura also dark; legs pale, femora and tibiae heavily dotted, latter with dark tips, tips of tarsal joints black, bristles on legs mostly black, but front- and mid-femora with some white bristles; hair on pleura white; abdomen black, middle and tip of some segments pale, much more so in the male, hair long black, but some at base white. Wings heavily marked, the veins and cross-veins mostly dark and often bordered with dark; dark streaks between the subcosta and radius, large spot at base of stigma, several above the cubitus, one at rhagma extending obliquely outward, and one at end of the anal vein; many smaller spots, and the marginal forkings dark. Hind-wings much less marked, but the venation is largely dark, the marginal forkings, outer gradates, rhagma, and several radial cross-veins more or less margined with dark. Fore-wings with costal area almost wholly biareolate, three or four cross-veins before the radial sector, outer two or three often connected, ten or eleven branches of radial sector, several cubitals connected, Banksian line fairly distinct. In hind-wings the costal area often partly biareolate, but sometimes only a few are even forked. Venation of both pairs with very long hairs. Male abdomen much longer and more slender than in the female, the

last segment about twice as long as high, appendages fully one half of the last segment.

Length fore-wing 22 to 27 mm., width 6.5 to 7.8 mm.

Length hind-wing 21 to 25 mm., width 5 to 6.8 mm.

Length abdomen ♀ 18 to 20 mm., ♂ 25 to 27 mm.

Specimens examined.—N. C.: Southern Pines, May. N. J.: Lahaway, July. Ga.: Millen, July; Savannah. Fla.: Auburndale. Ohio: Columbus. Mich.: Ludington; Port Huron, Berrien Co., July; Huron Co., July. Ontario: Hamilton, Giants Tomb, July. Also Upper Wisconsin River, Lakehurst, N. J. (Davis coll.). St. Simon's Island, Ga. (Cornell univ.).

CRYPTOLEON SIGNATUM (Hagen).

Plate 3, fig. 50.

Maracanda signata Hagen, Can. ent., 1887, 19, p. 215.

Interantennal mark usually broken, showing spots below antennae and a band above, vertex dark in middle, sometimes with a pale median line; palpi mostly pale, last joint of labial palpi with an outer scar; pronotum with two broad dark stripes near middle, each containing a pale spot in front; rest of notum dark, much streaked with pale, the scutelli largely pale; pleura dark, much marked with pale, the hair white; legs pale, femora and tibiae rather finely dotted with dark, tarsi dark on tips of the joints, femoral bristles partly white; abdomen black, in male much marked with pale above, hair almost wholly white, in male some on the basal segments above dark. Wings only lightly marked, although venation is mostly dark, only a few cross-veins or forks slightly margined with dark, sometimes a small spot at base of stigma, at rhexma, and at end of anal, no dark between subcosta and radius. Hind-wings less marked, usually dark dot at rhexma and stigma, the venation mostly dark. Fore-wings with the costal series normally wholly uniareolate, but in various specimens a few cells near middle may be crossed, usually three cross-veins before radial sector, sometimes two are connected, eight to ten branches of the radial sector, often a few cubitals connected, but sometimes all free, often a few cross-veins in the anal area, hairs on venation less numerous and shorter than in *C. nebulosum*. Abdomen of male elongate and slender, last segment not twice as long as high, appendages more than one half of last segment.

Length fore-wing 20 to 23 mm., width 5.2 to 6 mm.

Length hind-wing 19 to 22 mm., width 4 to 5 mm.

Length abdomen ♀ 15 to 16 mm., ♂ 20 to 22 mm.

Specimens examined.—White Fish Point, Lake Superior (TYPE). Mich.: Ludington, Berrien Co., July; Huron Co., July. Ohio: Sandusky; Columbus. Ill.: Havana. N. Y.: Rockaway Beach, Staten Island, August. R. I.: Weekapaug, July. Also Illinois (Amer. mus. nat. hist.).

CRYPTOLEON HENSHAWI Hagen.

Plate 2, fig. 29. Plate 3, fig. 55.

Maracanda henshawi Hagen, Can. ent., 1887, 19, p. 216.

The species agrees very closely with *signatum*; the dark of the vertex is broken up by several pale spots, the pronotal marks are the same, the rest of thorax and pleura also about the same, the legs are pale and dotted, but the front-femora are wholly brown on the outer sides; the abdomen (male only known) is streaked with pale above as in *signatum*, the hair is mostly white, with some dark above toward base. The wings are plainly more slender than in *signatum*, the fore-wings more heavily marked, spots on several of the radial cross-veins, in front of cubitus, as well as at stigma, at end of anal and a distinct oblique line from rhexma over gradates to near the tip, the venation is mostly dark, but the median vein in both pairs is mostly pale. In the hind-wings the markings are less distinct, but more than in *signatum*. Structurally it is similar to *signatum*, the costal area wholly one-celled, and in fact only a few veins near stigma forked, there are eight branches to radial sector, in the apical field very few cross-veins.

Length fore-wing 19 mm., width 4.6 mm.

Length hind-wing 17 mm., width 3.7 mm.

Length abdomen ♂ 23 mm.

Specimen examined.—Ore.: Umatilla, June (TYPE).

HESPEROLEON Banks.

Ent. news, 1913, 24, p. 64.

Antennae usually less than the diameter of the basal joints apart; labial palpi not longer than front-tarsi. Legs moderately short, basal tarsal joint rarely equal to next two united, always much shorter than apical joint; spurs variable in length, less than one to more than two joints long. Abdomen of male longer than in female and much longer than the wings. Fore-wings with one series of costal cells, except

sometimes toward the stigma, Banksian and intercubital lines usually fairly distinct, radial sector arises before cubital fork, first anal runs parallel to cubital fork for some distance, and connected thereto by less than nine cross-veins, second anal usually not forked, third usually forked.

Hind-wings with two to four cross-veins before radial sector (rarely with but one), second anal usually forked; first anal runs parallel to the cubital fork for some distance; Banksian line usually fairly definite, but intercubital indistinct or absent; the radial sector little, if any, before forking of cubitus.

TYPE.—*H. ferox*, Walker.

In the species assigned to this genus there is quite a wide variation; certain forms have the hind-margin of hind-wings near base concave, but in *abdominalis* it is hardly so, connecting the two series. In several, as *maculosus*, *tenuis*, *coquillettei*, and *abdominalis*, the spurs are equal to two tarsal joints, but some *abdominalis* hardly so, while in *blandus* they are fully one and one half joints, and in others grade down to less than one joint. These forms with the long spurs have the median vein unmarked, and all, except *maculosus*, has the hind-margin of hind-wing concave. In *maculosus*, and also in *yavapai* there is but one cross-vein before the radial sector in hind-wing, however these two forms are so different in spurs and other structures they should not be united against the other species. *H. irregularis* is the most distinct structurally, besides the irregular venation, the hind-wing is very narrow at base, the second anal not forked, and the antennae closer together than in other species; however in *maculosus* the second anal is also simple, and there is variation in space between antennae. The groups may be tabulated as follows:—

1. But one cross-vein before radial sector in hind-wing. *maculosus*, *yavapai*.
2. Hind-wing with second anal not forked; antennae very close together.
irregularis.
3. Spurs equal to two tarsal joints. *abdominalis*, *coquillettei*, *tenuis*.
4. Hind-margin of hind-wings toward base concave. *blandus*, *papago*.
5. Costal cross-veins spotted at each end; often a double costal series near stigma. *versutus*, *mexicanus*.
6. Abdomen banded with pale. *sackeni*.
7. All the other species.

In *H. coquillettei*, *maculosus*, and *yavapai* there is but one cross-vein between the second and third anal in the fore-wings, in the other species there are normally two such cross-veins, but in *H. papago*, about half the specimens have one, and half two.

The Nearctic species, twenty-five in number, are tabulated below. Some of the characters used may prove to be more variable with more material.

1. Abdomen banded with large pale spots. 2
Abdomen hardly if at all banded, marks, when present, lineate. 3
2. Second and third segments pale at tip as well as in middle; second and third anals of fore-wing connected twice. *sackeni*.
Second and third segments broadly pale in middle only; second and third anals of fore-wings connected but once. *yavapai*.
3. Labrum black; pronotum yellow, with narrow median stripes, and short side stripes; femora not dotted. *nigrilabris*.
Labrum pale. 4
4. Pronotum with broad, solid, median brown (or pink-brown) stripe; wings heavily dotted; hind-margin of hind-wings near base concave. *irregularis*.
Pronotum with median stripe divided by pale line at least in front, and more or less distinct lateral stripes. 5
5. Median vein pale (rarely marked); both scutelli with median dark line or spot; hind-spurs equal to two joints. 6
Median vein marked with dark and pale; at least mesoscutellum with two or more spots or streaks, else spurs not equal to two joints. 9
6. Median stripes of pronotum distinct, united behind, divergent in front. 7
Median stripes not visible behind furrow, only more or less distinct in front. 8
7. Wings practically without spots; hind-margin of hind-wings near base concave. *coquilletti*.
Wings heavily spotted; hind-margin of hind-wings near base convex. *maculosus*.
8. Fore-wings with the spots arranged largely in two longitudinal areas, with space between largely unmarked. *tenuis*.
Fore-wings with dots scattered fairly evenly over whole wing. *abdominalis*.
9. Hind-margin of hind-wing near base concave; femora dotted; costal cross-veins without large spot at outer ends; hair of abdomen long. 10
Hind-margin of hind-wing near base, straight or convex, not plainly concave. 11
10. Median pronotal stripes united behind; hairs on wing unusually long; hind-spurs hardly equal basal joint. *papago*.
Median pronotal stripes separate; hair of wings normal; hind-spurs equal one and one half joints. *blandus*.
11. Wings heavily spotted, the costal cross-veins spotted at each end. 12
Wings less marked, costal cross-veins not spotted at each end. 13
12. Clypeus black, or with two spots. *versutus*.
Clypeus pale, unspotted. *mexicanus*.
13. Scutelli with no more than median dark line; pronotum with median stripes absent or faint; vertex scarcely marked. *pallidus*.
At least mesoscutellum with double mark. 14

14. Labial palpi about as long as the front-tarsus; lateral stripes partly united to the median pair, tibia dotted *niger*.
Labial palpi plainly a little shorter than the front-tarsus 15
15. Lateral and median stripes united into a very broad stripe each side which contains a pale spot in front, and on outer sides a shorter dark stripe; no pale between bases of antennae *brunneus*.
Lateral stripes more separated from the median pair, and no distinct outer dark stripe toward margin of pronotum 16
16. Mesoscutellum with five black spots; front-femora and tibiae almost wholly pale; hair of the abdomen very short *minusculus*.
Mesoscutellum with two black stripes or a double mark 17
17. Coxae of front-legs with one or two white macrochaetae, four pronotal stripes separate; hind-femora usually dotted; usually three cross-veins before radial sector in hind-wings *hubbardi*.
Front-coxae without macrochaetae, only fine hairs 18
18. Femora dotted, sometimes on the hind-femora dense and connected, but evidently dotted 19
At least hind-femora not dotted, but more or less evenly infuscated . . . 21
19. Median stripes of pronotum united behind; hair on male abdomen long; male appendages long *douglasi*.
Median stripes separated; hair on male abdomen short as in female . . . 20
20. Male appendages equal to last segment of abdomen; rather larger. *carrizonus*.
Male appendages not one half of last segment, rather smaller . . . *texanus*.
21. Vertex with but one row of four dots; interantennal mark does not reach up to vertex; body very pale; male appendages short . . *quadripunctatus*.
Vertex with two rows of marks, or interantennal mark reaches up on vertex over first row 22
22. Male appendages much longer than the height of last segment 23
Male appendages not longer than height of last segment 24
23. Male appendages about half as long as last segment; spines on hind-femora black *assimilis*.
Male appendages nearly equal to last segment; spines on hind-femora white *singularis*.
24. Male appendages not equal to one half of last segment; femoral spines mostly black *ferox*.
Male appendages equal one half of last segment; femoral spines mostly white *intermedius*.

HESPEROLEON FEROX Walker.

Plate 1, fig. 17. Plate 3, fig. 71.

Myrmeleon ferox Walker, Cat. Neur. Brit. mus., 1853, pt. 2, p. 332.

Interantennal mark with little if any extension below, above often reaching first vertex row, but typically separate from it, the latter a

continuous band, second vertex row of two submedian spots with lateral extensions, and often an extension each side behind; last joint of labial palpi moderately swollen, partly black. Pronotum with four lines, usually connected at tips and sometimes in the middle, the median pair of lines rather narrowly separated. Rest of notum marked as in allied forms, mesoscutellum with two streaks, metascutellum with a double mark; pleura mostly dark; femora, especially hind-pair, more or less blackened, tibia sometimes with a dark line below, spines black. Abdomen with a pale stripe each side above, often not as broad as in related species, and sometimes scarcely noticeable in the female, hair very short in both sexes, mostly white, some black along the dorsal line. Wings with mostly dark veins, but little margined, a spot at base of pale stigma, one at rhagma, several along cubitus, sometimes forming short streaks, sometimes an oblique line out from rhagma, anal spot usually very faint, the median vein white in long stretches, radius not dark at end of every cross-vein; hind-wings much less marked.

Vertex high, rather less so in male; pronotum broader than long in middle; hind-spurs but little longer than basitarsus; in fore-wings three cross-veins before radial sector, in hind-wings two, about ten branches to radial sector; a few cubital cross-veins connected; in hind-wing the cubital fork is usually equal to or a little before radial sector, but not much difference, hind-margin near base convex, first anal with five to seven branches, first long, oblique, over six times as long as the cubital cross-vein above it. Abdomen of male much longer than wings, last segment about twice as long as high, appendages very short, divergent, not half as long as in allied species.

Length fore-wing 28 to 34 mm., width 7.8 to 9 mm.

Length hind-wing 26 to 31 mm., width 5.8 to 7.5 mm.

Length abdomen ♀ 23 to 27 mm., ♂ 30 to 37 mm.

Common in far west. *Brachynemurus peregrinus* Hagen is a synonym of this species, I have examined both types.

Specimens examined.—Calif.: Haviilah (TYPE of *peregrinus*); San Bernardino, July; Sierra Nevada Mts., July; Coronado, July; San Francisco. Ore.: Umatilla, June. Wash.: Camp Umatilla; Yakima; Ainsworth. Nev.: Humboldt River; Reno; Verdi, July; Ormsby Co. Ariz.: Thumb Butte; Jerome; Palmerlee; Prescott; Graham Mts., June; Tucson. Utah: Vinyard, June; Beaver Valley, August; Bellevue, June. N. M.: Jemez Mts., July; Albuquerque. Also Beaver Valley, Utah (Brooklyn mus.); California, Oregon (Amer. mus. nat. hist.). Nogales, Arizona (Cornell univ.), Las Cruces, New Mexico (N. M. agric. coll.).

HESPEROLEON ASSIMILIS (Banks).

Plate 1, fig. 19. Plate 3, fig. 65.

Brachynemurus assimilis Banks, Proc. Ent. soc. Wash., 1903, 5, p. 174, pl. 3, fig. 1.

Interantennal mark not extending much below antennae, above usually reaching first vertex row, sometimes with a median pale spot, second vertex row of two spots laterally extended; last joint of labial palpi moderately swollen and partly brown. Pronotum with four lines, all reaching the front-margin, and there connected, and sometimes connected in middle, so that there is a pale streak or two spots each side. Rest of notum marked as usual, two streaks on the scutelli; pleura largely dark; femora more or less embrowned, not dotted, spines black, some on femora are white. Abdomen pale each side above on basal two thirds, leaving a narrow black line, hair moderately long at least in the male, mostly white, but some black along median line. Wings with large dark mark at base of the pale stigma, small spot at rhexma, and several small ones along the cubitus, veins mostly dark, but not bordered, median vein mostly dark, radius dark at end of nearly every cross-vein; hind-wings scarcely marked.

Vertex in female much elevated, in male much less so; pronotum a little broader than long in the middle, not narrowed in front; hind-spurs equal about one and one half joints; male abdomen much longer than the wings, last segment fully three times as long as high, appendages long, slender, subparallel, not much curved, equal to about one half of last segment. In fore-wing three cross-veins before radial sector, in hind-wings two; radial sector with about ten branches; several cubital cross-veins connected; in hind-wings cubital fork is usually a little before the radial sector; hind-margin toward base convex, first anal with about six branches, the first fully six times longer than a cubital cross-vein.

Length fore-wing 30 mm., width 6 to 8 mm.

Length hind-wing 26 mm., width 5 to 7 mm.

Length abdomen ♀ 24 mm., ♂ 32 to 39 mm.

Specimens examined.—Calif.: Tehama, August. (TYPE). Oregon.

HESPEROLEON SINGULARIS (Currie).

Plate 3, fig. 62, 73. Plate 4, fig. 78.

Brachynemurus singularis Currie, Proc. Ent. soc. Wash., 1903, 5, p. 284.

Interantennal mark with a slight median extension, first vertex row of an elongate spot each side, usually without median mark, second

vertex row of four usually connected spots. Last joint of labial palpi not much swollen, brown. Pronotum with four separated brown stripes, the outer ones hardly reach in front of the furrow; rest of notum with large brown spots, often divided, two on mesoscutellum, a median one on metascutellum; pleura much marked with brown; femora (at least hind) more or less embrowned, also with a few small spots; tibiae scarcely marked. Abdomen with pale stripe each side above reaching one half-way to end in male. Wings with dark spot before the pale stigma, at rhagma, and several along cubitus; many cross-veins dark, median interrupted with dark, but largely pale; radius dark at end of each cross-vein; hind-wings scarcely marked. Hair on female abdomen white, that of male partly black, not very short, femoral spines mostly white, tibial black.

Vertex of female considerably elevated, in male less so; pronotum broader than long in the middle; hind-tibia longer than hind-femur, hind-spurs scarcely more than the basitarsus, which is rather long. Last segment male abdomen fully twice as long as high, the appendages as long as segment, much curved. In fore-wing three cross-veins before radial sector, two in hind-wings; radial sector usually with ten branches. In hind-wing hind-margin nearly straight or slightly convex, first anal with about five branches, first oblique and fully five times as long as a cubital cross-vein.

Length fore-wing 22 to 23 mm., width 5.5 to 6 mm.

Length hind-wing 19 to 20 mm., width 5 to 5.5 mm.

Length abdomen ♀ 16 mm., ♂ 20 mm.

Specimens examined.—Ariz.: Florence, October; Colorado River. Also from Utah (Brooklyn mus.), Currie described it from Phoenix, Ariz.

HESPEROLEON INTERMEDIUS (Currie).

Plate 4, fig. 76, 88.

Brachynemurus intermedius Currie, Proc. Ent. soc. Wash., 1903, 5, p. 283.

Interantennal mark small, sometimes extending upward to the first vertex row, rarely with an extension below, second vertex row of two transverse marks; last joint of labial palpi much enlarged, partly brown. Pronotum with four straight complete stripes, connected in front. Rest of notum with streaks and spots, mesoscutellum with two streaks, metascutellum with a basal double mark; pleura largely dark; femora not dotted, but faintly embrowned, especially on hind-legs, sometimes a line below on hind-tibia. Abdomen with two large

streaks above, reaching about to tip, at least in male, hair short, white. Wings with dark spot at base of pale stigma, a spot a rhagma with faint line extending obliquely outward, one or two marks along cubitus, and faint mark at end of anal vein, median vein mostly pale, but some dark marks, radius brown at end of each cross-vein. Vertex of female much elevated, in male less so; pronotum broader than long in middle; hind-spurs but little longer than basal joint, spines mostly black; abdomen of male a little longer than wings, last segment a little more than twice as long as high, the appendages very short, divergent. In fore-wings three cross-veins before radial sector, in hind-wings two; about eight branches to radial sector; several cubitals connected; in hind-wings cubital fork a little before radial sector; hind-margin of hind-wings near base convex, first anal vein with about four branches, first five times as long as a cubital cross-vein above it.

Length fore-wing 21 to 24 mm., width 5.5 mm.

Length hind-wing 19 to 22 mm., width 5 mm.

Length abdomen ♀ 18 mm., ♂ 25 mm.

Specimens examined.—Ariz.: Phoenix, April. Calif: Death Valley, Mono Co., April.

Described by Currie from Phoenix and Wickenburg, Ariz.

HESPEROLEON CARRIZONUS (Hagen).

Plate 1, fig. 20. Plate 3, fig. 61.

Brachynemurus carrizonus Hagen, Can. ent., 1888, 20, p. 93.

Interantennal mark with median extension below, above usually separated from the first vertex row which is a continuous line, second vertex row of two large submedian spots with lateral extensions, rarely reaching eyes; last joint of labial palpi much swollen, mostly black. Pronotum with four stripes, subequal in width, and all reach the front, usually not connected. Rest of notum spotted as usual, mesoscutellum with two stripes, metascutellum with a large double mark; pleura about one half dark; femora much dotted, tibiae less so, spines black, some white on front- and mid-femora. Abdomen with pale stripe each side above, leaving a fairly broad median line, in the female the pale less apparent, hair very short in both sexes, mostly white, but a few black ones intermixed. Wings with veins mostly dark, but not margined, spot at base of pale stigma, a small one at rhagma, and other small ones along cubitus, end of anal vein scarcely marked, median vein

mostly white, dark at ends of a few cross-veins, radius dark at end of nearly all cross-veins.

Vertex of female much elevated, in male not much less so; pronotum broader than long in the middle; hind-spurs little longer than basal joint. In fore-wings three cross-veins before radial sector, in hind-wings two; radial sector with about ten branches; in hind-wings radial sector and cubital fork are often equal or nearly so; hind-margin near base convex, first anal with about four branches, first more than four times as long as cubital cross-vein above it; in fore-wings a few cubital cross-veins connected; male abdomen a little longer than wings, last segment not twice as long as high, the appendages fully equal last segment, slender, upcurved, and toward each other.

Length fore-wing 23 to 27 mm., width 6.5 to 7 mm.

Length hind-wing 21 to 24 mm., width 5 to 5.5 mm.

Length abdomen ♀ 19 to 21 mm., ♂ 24 to 26 mm.

Specimens examined.—Tex.: Carrizo Springs (TYPE); Rio Frio, May; Amarillo; Brownsville, May; San Antonio; Sabinal, May. N. M.: Mesilla, July. Ariz.: Phoenix, August.

HESPEROLEON DOUGLASI, sp. nov.

Plate 1, fig. 16. Plate 3, fig. 63.

Interantennal mark not extending much below the antennae, above usually not reaching the first vertex row, latter rather broad, continuous, second vertex row of two large submedian spots with lateral extensions; last joint of labial palpi moderately swollen, partly brown. Pronotum with four stripes, the median pair united behind, divergent in front, the lateral stripes usually not connected to median ones, sometimes not reaching in front of furrow. Rest of notum spotted as usual, two stripes on the mesoscutellum and a double mark on the metascutellum; pleura largely dark; legs dotted, most prominent on femora, spines mostly black, some femoral ones white. Abdomen with pale stripe each side above, leaving a rather broad median dark stripe, pale less extensive in female, the hair is mostly white, in female it is short and appressed as in *H. carrizonus*, in male long, more erect, three to five times as long as in male of *H. carrizonus*. Wings as in *H. carrizonus* and allies, small mark near stigma, at rhexma and several along cubitus, and one at end of anal vein, venation largely dark.

Vertex of female high, of male moderately high; pronotum broader than long in middle, not narrowed in front; hind-spurs not longer than

basitarsus. In fore-wings three cross-veins before radial sector, in hind-wings two; radial sector with about eleven branches; several cubital cross-veins connected; in hind-wing but little difference between cubital fork and radial sector, hind-margin near base is convex, first anal with about five branches, first very oblique, six times as long as cubital cross-vein above it. Abdomen of male longer than wings, somewhat longer than in *H. carrizonus*, last segment little if any longer than high, appendages very long, longer than last segment, slender, upcurved.

Length fore-wing 25 to 30 mm., width 7 to 8.4 mm.

Length hind-wing 22 to 26 mm., width 6 to 7 mm.

Length abdomen ♀ 22 to 25 mm., ♂ 27 to 31 mm.

Specimens examined.—Calif.: Coronado; Pasadena. Utah: St. George. Ariz.: Nogales (TYPE.—M. C. Z. 15,745), Phoenix; Florence.

Formerly considered *H. carrizonus*, but much longer hair of male abdomen, united median stripes, and minor differences separate it.

HESPEROLEON QUADRIPUNCTATUS Currie.

Plate 4, fig. 77, 96.

Brachynemurus quadripunctatus Currie, Can. ent., 1898, 30, p. 136.

Interantennal mark small, barely extending below antennae, including a pale median spot; first vertex row absent, second of four well-separated spots; last joint of labial palpi moderately swollen, partly brown; pronotum with four well-separated brown lines, the outer ones sometimes nearly connected to inner pair at anterior end, sometimes these lines are much reduced and nothing shows in front of the furrow; rest of notum with elongate marks, two on mesoscutellum, and a double mark on metascutellum; pleura with brown streaks; femora and usually tibiae unmarked. Abdomen with pale stripe each side on basal part, not always distinct in the female, in male sometimes reaching the tip; hair on abdomen very short, white. Wings with dark spot at base of pale stigma, at rhagma, and sometimes along the cubitus; median vein interrupted with dark a few times, radius usually dark at each cross-vein; hind-wings unmarked. Vertex not much elevated; pronotum broader than long in middle; spines on femora mostly white, on tibia black, short, few being twice the width of joint; hind-spurs but little more than basitarsus; last segment of abdomen about twice as long as high, appendages very short divergent. In fore-wings

usually three cross-veins before radial sector, in hind-wings two, about nine to eleven branches to radial sector; in hind-wing cubital fork before radial sector; hind-margin of hind-wings convex toward base, first anal vein with about four to six branches, first long, oblique, six times as long as cubital cross-vein above it.

Length fore-wing 22 to 27 mm., width 6 to 7.5 mm.

Length hind-wing 20 to 25 mm., width 5 to 6 mm.

Length abdomen ♀ 18 to 19 mm., ♂ 26 mm.

Specimens examined.—Calif: Indio, July; Lancaster, July, August. Ariz.: Phoenix, August.

Currie described a female from San Bernardino Co., California and a long series from Phoenix, Ariz.

HESPEROLEON TEXANUS Banks.

Plate 1, fig. 11. Plate 4, fig. 98.

Brachynemurus texanus Banks, Proc. Ent. soc. Wash., 1903, 5, p. 175, pl. 3, fig. 3.

Interantennal mark small, sometimes with median projection below, and sometimes enclosing a pale spot between antennae; first vertex row usually a continuous line, from eye to eye, second row more broken, the middle spots sometimes more prominent; last joint labial palpi moderately swollen; mostly dark. Pronotum with four lines, submedian pair rather close to each other, sometimes broken at the furrow, laterals more separated, sometimes not reaching forward of furrow, sometimes more developed and connected at tips to submedian. Rest of notum streaked with dark, scutelli with two streaks or a double spot, mesoscutellum often with three spots behind; pleura mostly dark; femora heavily dotted, tibiae less so, spines black. Abdomen with pale stripe each side above, fainter in females, in some males so broad as to extinguish the median dark line. Wings with white stigma, dark mark at base, one at rhexma, one at end of anal vein, and usually several along the cubitus, median vein and radius largely dark, but not at every cross-vein. Hair of abdomen short, mostly white, but some black intermixed. Vertex only moderately elevated in female; pronotum hardly as broad as long in middle, not narrowed in front; hind-spurs a little longer than basitarsus; in fore-wing three cross-veins before radial sector, in hind-wing two; in hind-wing cubital fork usually before radial sector, usually a few cubitals connected, in hind-wing the hind-margin toward base is convex, first anal with about five

branches, the first very oblique and fully six times as long as the cubital cross-vein above it. Male abdomen but little longer than wings, last segment about three times as long as high, the appendages very short and divergent.

Length fore-wing 18 to 20 mm., width 4.5 to 5.5 mm.

Length hind-wing 16 to 18 mm., width 4 to 5 mm.

Length abdomen ♀ 15 to 18 mm., ♂ 25 mm.

Specimens examined.—Tex.: Laredo (TYPE). Kans: Morton Co. N. M.: Albuquerque. Ariz.: Tempe; Phoenix, July. Also Ogden, Utah. Arizona (Amer. mus. nat. hist.). Douglas, Arizona. Clark Co., Kansas (Snow coll.).

HESPEROLEON PALLIDUS (Banks).

Plate 3, fig. 51, 66.

Brachynemurus pallidus Banks, Ent. news, 1899, 10, p. 171.

Interantennal mark very small, and often broken or indistinct, sometimes a median extension below; vertex rows faint, or absent, usually two submedian spots of second row show, and sometimes the first row connected to interantennal mark; last joint of labial palpi not much swollen, partly brown; pronotum little marked, the lateral stripes almost broken, a dark spot behind and one at the furrow, sometimes the median lines show faintly in posterior part; rest of notum pale, mostly unmarked, sometimes a stripe over wing-base, scutelli with faint median line; pleura largely pale; femora and tibiae sparsely dotted if at all, spines black. Abdomen mostly pale on base, a median dark line above, hair in female mostly white, rather long, in male mostly black. Wings very faintly marked, stigma white, cross-veins and the connections mostly dark, but not margined; median vein marked, but not at every cross-vein, radius usually marked at each cross-vein. Vertex in female considerably elevated, less so in male; pronotum hardly as broad as long in middle, not narrowed in front; hind-spurs barely longer than basitarsus; last segment male abdomen but little longer than high, appendages fully as long, curved. In forewings three cross-veins before radial sector, in hind-wings two; radial sector with five to seven branches; few if any cubitals connected; in the hind-wings the radial sector is sometimes equal to or even a trifle before cubital fork; hind-margin faintly convex, first anal vein with about five branches, oblique, the first fully four times longer than cubital cross-vein above it.

Length fore-wing 19 to 21 mm., width 4.5 to 5 mm.

Length hind-wing 16 to 18 mm., width 3.5 to 4 mm.

Length abdomen ♀ 15 mm., ♂ 20 mm.

Specimens examined.—Ariz.: Phoenix, August (TYPE); Florence, October; Prescott, August; Catalina Mts., August.

HESPEROLEON MINUSCULUS (Banks).

Plate 1, fig. 7. Plate 3, fig. 54, 67.

Brachynemurus minusculus Banks, Trans. Amer. ent. soc., 1899, **25**, p. 203.

Interantennal mark brown, emarginate below and with a short median extension, sometimes showing a faint pale spot between antennae; first vertex row of a long mark each side and one or two smaller in the middle, second row not as distinct, but usually the middle spots indicated; last joint of labial palpi much enlarged, black. Pronotum with four black lines, the lateral rather remote from the middle pair, and usually stop at the furrow. Rest of notum spotted with black, mesoscutellum with five spots or dots, the metascutellum with a large double mark; pleura largely dark; front-legs usually unmarked, but mid- and hind-femora may be dark on outer sides, spines mostly black. Abdomen with a pale streak each side above, reaching to tip in some specimens; hair very short in both sexes, white. Wings with dark spot at base of stigma, one at rhexma and sometimes oblique line outward, and more or less along cubitus; median vein dark only at a few cross-veins, radius not dark at every cross-vein; hind-wings not marked.

Vertex moderately elevated in the female, less so in the male; pronotum much broader than long in middle; hind-spurs but little longer than basal joint of tarsus; male abdomen a little longer than wings, the last segment about three times as long as high, the appendages very short, divergent. In fore-wings three cross-veins before radial sector, in hind-wings two; about nine branches to radial sector; a few cubital cross-veins connected; in fore-wing radial sector before cubital fork as usual, in hind-wing cubital fork before radial sector, however not much difference in either wing; in hind-wing the hind-margin is convex, first anal with four to five branches, unequal, the first very oblique, fully five times as long as cubital cross-vein above it.

Length fore-wing 19 mm., width 5 mm.

Length hind-wing 17 mm., width 4 mm.

Length abdomen ♀ 14 mm., ♂ 20 mm.

Specimens examined.—Calif.: Lancaster, July. N. M.: Mesilla, September; Las Cruces.

Currie records it from Winslow, Ariz.

HESPEROLEON BRUNNEUS (Currie).

Plate 1, fig. 14. Plate 4, fig. 97.

Brachynemurus brunneus Currie, Can. ent., 1898, 30, p. 273.

Interantennal mark large, usually with a median extension below, above usually extending up to and uniting with the first vertex row, sometimes a couple of pale spots before the row, second vertex row of two long spots, usually connected, a median spot behind; last joint of labial palpi not much swollen, partly brown. Pronotum with a submedian pair of broad stripes (really four stripes united), each stripe with a pale spot in front-part, laterally there is often a brown stripe reaching to furrow. Rest of notum with dark occupying most of surface, two spots and sometimes a median line on mesoscutellum, metascutellum mostly black; pleura largely dark, some sutures pale; femora dotted, hind-femora largely black, tibiae also dotted, spines black. Abdomen dark, in male with pale line each side above on basal part, hair rather long, largely black, in female much more white on venter. Wings with dark spot at base of the pale stigma, line up from rhagma, several spots along cubitus, and one at end of anal; some cross-veins margined, median largely or wholly dark, radius not dark at end of every cross-vein.

Vertex slightly swollen; pronotum as broad as long in middle, somewhat narrowed in front; hind-spurs scarcely longer than basitarsus. In fore-wings three cross-veins before radial sector, two in hind-wings, some cubital cross-veins connected, about ten branches to radial sector; in hind-wing radial sector usually before cubital fork, hind-margin near base slightly convex, about six to ten branches to first anal vein, but none very long, first more than three times longer than cubital cross-vein above it. Abdomen of male much longer than wings, last segment about three times as long as high, appendages short, about as long as height of segment.

Length fore-wing 24 to 28 mm., width 6 to 7 mm.

Length hind-wing 22 to 26 mm., width 5 to 6 mm.

Length abdomen ♀ 20 to 21 mm., ♂ 33 to 35 mm.

Specimens examined.—Calif.: Claremont; Dunsmuir (COTYPE); Pasadena, June; Mt. Wilson, June; Modoc Co., July; San Gabriel Mts., July; San Jacinto Mts., July; Sawmill Canyon, Kern Co., June. Nev.: Reno; Verdi, July. Utah: Eureka, July; Stockton, July. Ariz.: Palmerlee, July. Colo.: Estes Park, August (TYPE *centralis*); South Park; Golden. B. Col.: Peachlands, July. Also Beaver Valley, Utah

(Brooklyn mus.), Las Cruces, N. M. (N. M. agric. coll.), Nogales, Arizona (Cornell univ.),

Currie records it from Yellowstone National Park, Sage Creek, Wyoming, Dunsmuir and Los Angeles Co., California.

HESPEROLEON NIGER Currie.

Plate 1, fig. 6. Plate 3, fig. 59.

Brachynemurus niger Currie, Can. ent., 1898, 30, p. 134.

Interantennal mark of moderate size above and below antennae, first and second vertex rows arc continuous lines from eye to eye; last joint labial palpi partly dark. Pronotum with the four stripes broad and but narrowly separated, in front the laterals connected to the median; mesonotum mostly dark with two rows of pale spots, mesoscutellum with two dark streaks, metascutellum with a large spot nearly covering it; pleura mostly dark; femora mostly dark, tibiae much spotted, tarsi largely black; abdomen lineate with pale on base, hair rather short, largely white.

Wings heavily marked, large spot at base of the stigma, spot on last connecting cross-vein to radius, line up from rhagma, basal part of cubitus almost continuous streak, and beyond another streak, a short mark up from end of the anal vein, most of the forks distinctly marked; venation largely dark, the pale spaces comparatively few and short; hind-wing with spot at base of stigma.

Vertex moderately well elevated; labial palpi elongated, basal joint as long as the apical, latter much swollen, neither as long as in *Scoto-leon longipalpis*; pronotum about as broad as long in the middle, not narrowed in front; hind-spurs scarcely longer than basitarsus, no coxal macrochaetae; leg-spines mostly black, some on front- and mid-femora white; in fore-wing radial sector before cubital fork, in hind-wing the cubital fork a trifle before radial sector; in fore-wing three cross-veins before radial sector, in hind-wing two; about ten branches to radial sector; hind-margin of hind-wing near base convex, first anal with about eight branches, the first fully six times as long as a cubital cross-vein.

Length fore-wing 26 mm., width 7 mm.

Length hind-wing 24 mm., width 6.3 mm.

Male unknown.

The only specimen I have seen is from Prescott, Arizona. Currie described it from Ft. Grant, and later recorded it from Camp Creek, and Prescott.

HESPEROLEON NIGRILABRIS (Hagen).

Plate 1, fig. 9. Plate 3, fig. 52.

Brachynemurus nigrilabris Hagen, Can. ent., 1888, 20, p. 72.

Labrum black; interantennal mark large, deep black, extending broadly below antennae, and often reaching up to first vertex row, however usually a pale spot or line before vertex row, latter broad, continuous, second vertex row of two large spots near middle, connected in front to first row, and often with extensions behind as well as laterally; last joint of palpi moderately swollen, blackish. Pronotum with four lines, the median pair united behind, slightly separated in front, laterals not reaching in front of furrow, slightly oblique. Rest of notum mostly black on sides and pale in middle, the mesoscutellum with two streaks, metascutellum with a double spot; pleura mostly dark; femora often darkened above near tips, tibia of front pair sometimes much darkened, mid-tibia with subbasal and apical bands, hind-tibia with apical band and line below, spines black. Abdomen black, usually little if any trace of the pale streaks, hair fairly long, white above and below. Wings with large white stigma, veins partly dark, but rarely margined, median almost wholly white, radius dark at ends of cross-veins, sometimes a faint cloud near stigma and at rhexma. Vertex much elevated, somewhat less so in the male; pronotum about as broad as long in the middle; hind-spurs little longer than basal joint; in fore-wings three or four cross-veins before radial sector, in hind-wings two or three; radial sector with about ten branches, only a few if any cubital cross-veins connected; in fore-wing radial sector only a little before cubital fork, in hind-wings the radial sector usually a little beyond cubital fork; hind-margin of hind-wings near base convex, first anal with five or six branches, the first five times as long as a cubital cross-vein. Male abdomen much longer than the wings, last segment two and one half to three times as long as high, appendages about as long as segment is high.

Length fore-wing 26 to 29 mm., width 7.5 to 9 mm.

Length hind-wing 22 to 26 mm., width 6 to 7 mm.

Length abdomen ♀ 20 to 24 mm., ♂ 28 to 36 mm.

Specimens examined.—Colo.: Manitou (TYPE); Garden of Gods, July; Berkeley, June; Colorado Springs; Golden; Boulder, July; Ft. Collins, June; Denver, July; Clear Creek. S. Dak.: Custer Co. Kans.: Seward Co. Utah: Ogden, August; Farmington, July; Vinyard, July; Stockton, June. N. M.: Albuquerque, July; Las Vegas;

Tularosa, August; Mesilla Park, September. Ariz.: Phoenix; Palmerlee, August; Prescott, June, September. Nev.: Franktown. Also Nebraska. In other collections Beaver Valley, Utah (Brooklyn mus.), La Cueva, Organ Mts., St. Augustine, Las Cruces, New Mexico (N. M. agric. coll.), Santa Fe, New Mexico, Nogales, Oracle, Catalina Mts., Arizona (Cornell univ.).

HESPEROLEON BLANDUS (Hagen).

Plate 4, fig. 75, 84.

Myrmeleon blandus, Hagen, Synop., 1861, p. 235.

Interantennal mark goes but little below the antennae, sometimes with short median extension, above usually reaching and including the first vertex row, second vertex row of two submedian spots with more or less distinct lateral extensions; last joint of labial palpi scarcely enlarged, partly brown. Pronotum with four stripes, the median pair well separated, the lateral shorter, rather oblique and arising from the base of the median pair; sometimes the laterals reach forward to front, almost completely uniting with the median pair. Rest of notum with large spots, two dark streaks on the mesoscutellum, a median spot, narrowed behind on metascutellum; pleura largely dark; front-femora and tibiae usually unmarked, other femora dotted, tibiae less so, spines black. Abdomen pale on base above, with a narrow, median, dark line; hair long, largely black. Wings scarcely marked, stigma yellowish, no large spots, the cross-veins partly and other veins at connections and the forks dark, but not margined; hind-wings still less marked. Vertex much elevated in female, less in male; pronotum much broader than long in middle, scarcely narrowed in front; hind-spurs about equal one and one half joints; male abdomen longer than wings, last segment about three or four times as long as high; the appendages slender, curved, one half of the last segment; in fore-wing usually three cross-veins before radial sector, in hind-wings two; radial sector with about nine branches; few if any of cubitals connected; in fore-wing radial sector before the cubital fork, in hind-wing about equal; hind-margin of hind-wings near base concave, first anal with about six to eight branches, all short, and subequal, first about three times a cubital cross-vein.

Length fore-wing 20 to 22 mm., width 4.5 to 5.2 mm.

Length hind-wing 18 to 20 mm., width 3.8 to 4 mm.

Length of abdomen ♀ 19 to 20 mm., ♂ 25 mm

Specimens examined.—N. M.: Pecos River (TYPE); Ft. Wingate, May; Albuquerque, July. Colo.: South Park; Trinidad, June. Wyo.: Bridger Basin. Utah: Provo. Nev.: Verdi, July. Also Colorado (Cornell univ.).

HESPEROLEON PAPAGO (Currie).

Plate 1, fig. 1.

Brachynemurus papago Currie, Can. ent., 1899, **31**, p. 361.

Interantennal mark with median extension usually to clypeus, and often lateral extensions down by the eyes. First vertex row of three linear spots, second row of five, more or less connected; last joint of labial palpi brown, not strongly swollen. Pronotum with four stripes, the medium pair united in posterior half, divergent in front, the lateral bowed outward in anterior part, the lower posterior sides often with one or two brown spots. Rest of notum with many brown spots, mostly linear, a pale median line, two marks on the scutelli; pleura with brown spots and streaks, but upper part largely pale; thorax with many white and some black bristles. Femora and tibiae much dotted, sometimes the dots confluent. Abdomen brown, with a pale line each side above on basal part; dorsal hair rather long, mostly black, some white intermixed, mostly black below. Wings with white stigma, dark spot at base, a spot behind, several along the cubitus, and obliquely up from end of anal. Median vein marked; radius with long streaks of pale and dark, not marked at every cross-vein; hind-wings hardly marked.

Vertex in both sexes but little swollen; pronotum fully as broad as long in middle; hind-tibia longer than femur, basitarsus about equal two joints, hind-spurs hardly equal basal joint; male abdomen longer than hind-wings, appendages very short, not one half of short last segment. All hairs on wing-veins very long, in fore-wing three cross-veins before radial sector, in hind-wings two cross-veins; eight to ten branches of radial sector; several cubital cross-veins and usually a few anals connected; in hind-wing radial sector is usually before cubital fork; near base hind-margin concave, first anal with about six branches, all rather short, subequal.

Length fore-wing 22 to 26 mm., width 5.5 to 7 mm.

Length hind-wing 20 to 23.5 mm., width 5 to 6 mm.

Length abdomen ♀ 22 mm., ♂ 26 to 27 mm.

Specimens examined.—Calif.: San Gabriel Mts., July; Laguna

Beach; Claremont; Stanford Univ. Utah: Coal Creek, Iron Co., June; Hurricane, June, August; Bellevue, June; Provo. Tex.: San Antonio.

Currie described it from Madera Canyon, Santa Rita Mts., Arizona.

HESPEROLEON HUBBARDI (Currie).

Plate 1, fig. 13. Plate 4, fig. 90.

Brachynemurus hubbardi Currie, Can. ent., 1898, **30**, p. 241.

Interantennal mark emarginate below, above extending up to and including the first vertex row, sometimes a minute pale spot between bases of antennae, second vertex row of a couple of submedian marks, laterally unmarked or faint. Last joint labial palpi not very large, partly brown. Pronotum with four well-separated brown lines, sometimes the laterals are heavier, and sometimes these or all are interrupted at the furrow, or in small specimens all may be faint, especially in front; rest of notum with elongate marks, two on each scutellum; pleura mostly brown, with many pale spots; femora and tibiae more or less dotted, the spines black, except some on front- and mid-femora; abdomen above on basal part largely pale, with a median dark line, dorsal hair mostly black, ventral white, all fairly long; front-coxae with one or two white macrochaetae, wings with small spot near the stigma, latter white, elsewhere unmarked; veins much interrupted with brown, median vein partly dark, radius marked at end of cross-veins; hind-wings unmarked.

Vertex but little swollen; pronotum about as broad as long; hind-spurs a little longer than basitarsus; last segment of male abdomen about four times as long as high, appendages long, slender, bent beyond middle, about equal one half of last segment. In fore-wings three or four cross-veins before radial sector, in hind-wings also three or four, rarely but two; in hind-wing the radial sector and cubital fork are about equal, radial sector with about ten branches; few if any cubitals connected; hind-margin of hind-wing slightly convex, first anal with about seven to ten branches, first more than three times longer than cubital cross-vein above it.

Length fore-wing 20 to 28 mm., width 5 to 7.5 mm.

Length hind-wing 18 to 25 mm., width 4.5 to 6 mm.

Length abdomen ♀ 19 to 22 mm., ♂ 33 to 38 mm.

Specimens examined.—Ariz.: Phoenix, August; Oracle, August; Reef; Nogales, July; Thumb Butte, July; Palmerlee, July; Huachuca Mts., August. N. M.: Albuquerque. Kans.: Morton Co. Tex.:

Carrizo Springs. Also from Tucson, Arizona (Amer. mus. nat. hist.), Nogales, Oracle, and Huachuca Mts., Arizona (Cornell univ.), Mesilla, La Cueva, Organ Mts., New Mexico (N. Mex. agric. coll.), Huachuca Mts., Arizona (Brooklyn mus.).

Described by Currie from Ft. Grant, Arizona. *Brachynemurus cockerelli* Banks (Ent. news, 1902, **13**, p. 86) is a synonym.

HESPEROLEON HUBBARDI NUBECULIPENNIS (Currie).

Brachynemurus hubbardi nubeculipennis Currie, Proc. Ent. soc. Wash., 1903, **5**, p. 277.

In this variety there is a distinct mark on the rhégma, usually also marks along the cubitus, and more on forks of veins; the species is not as yellow as typical *hubbardi*; and the pronotal stripes are rather more heavy; the male appendages are the same.

Specimens examined.—N. M.: Jemez Mts., July, August. Utah: Bellevue, June; Parowan Canyon, Iron Co., July.

Currie described it from Phoenix and Prescott, Arizona.

In some small specimens from Phoenix, the wings are fairly well-marked, and the insect scarcely yellow. In two from Carrizo Springs, Tex. the pronotal stripes are nearly absent.

In two males (Boulder, Colo., and Seward Co., Kans.) the coloration is as in typical *hubbardi* but the male appendages are much shorter, hardly longer than the height of the last segment. These merit a varietal name as much as the *nubeculipennis* and I propose *Hesperoleon hubbardi* var. *curtus*, var. nov. (Plate 4, fig. 95). The male appendages do not bend downward as in the other forms, and are much shorter, otherwise I cannot find differences.

HESPEROLEON VERSUTUS (Walker).

Plate 1, fig. 23. Plate 4, fig. 85.

Myrmeleon versutus Walker, Cat. Neur. Brit. mus., 1853, pt. 2, p. 331.

Interantennal mark large, shining deep black, extending down on face, with the clypeus or two spots thereon black, usually leaving a pale spot on lower face; upward the mark extends over vertex, leaving a pale spot each side near eyes, in some specimens it does not reach the second vertex row of spots; last joint of labial palpi scarcely swollen, partly black. The pronotum shows the usual four stripes, often well separated, but sometimes united more or less and enclosing a pale

stripe or two spots each side. Rest of notum marked with dark, the scutelli with two streaks; pleura mostly dark brown; femora and tibiae more or less dotted, rarely embrowned; abdomen in male with two pale streaks each side above on basal two thirds or more, the upper streak much the broader, the dark median line sometimes evanescent; female with one pale line above each side on basal part, sometimes indistinct; hair on abdomen mostly black, fairly long. Wings heavily marked with small brown spots, subequal in size; stigma yellow, no line from rhagma nor up from anal vein. Practically every fork and every cross-vein is brown and more or less bordered, the costal cross-veins with spots at each end; hind-wings less heavily marked.

Vertex moderately elevated in both sexes; pronotum as broad or broader than long in middle; hind-spurs equal one and one half joints, femoral and tibial spines black. The male abdomen is but little longer than the hind-wings, the last segment less than three times as long as broad, and the appendages about two thirds of joint. In fore-wings three or four cross-veins before radial sector, in hind-wing two to four; about ten branches to radial sector; usually a few cubital cross-veins connected; in hind-wings the cubital fork is usually a little before radial sector; in the costal area of fore-wings there are several cross-veins connected, but not the series of typical *Brachynemurus*; hind-margin of hind-wings a little convex, first anal with about six or seven branches, first fully three times longer than cubital cross-vein above it.

Length fore-wing 21 to 22 mm., width 5.5 to 7 mm.

Length hind-wing 19 to 20 mm., width 4.5 to 6 mm.

Length abdomen ♀ 17 mm., ♂ 25 mm.

Specimens examined.—N. M.: Pecos; Sapello Canyon. Arizona (Morrison).

HESPEROLEON MEXICANUS (Banks).

Plate 4, fig. 87.

Brachynemurus mexicanus Banks, Proc. Cal. acad. sci., 1895, ser. 2, 5, p. 520.

Very similar to *H. versutus*. Interantennal mark is emarginate just below antennae, and does not extend down on face, nor is there black on clypeus, upward the mark sometimes reaches the second vertex row, sometimes the second row represented by two transverse spots. The rest of markings is the same as in *H. versutus*, the structure is also nearly the same in the female, but in the male the vertex is less swollen than in *versutus* and the male abdomen is very much longer than the wings, all the segments being lengthened, the last one three to four

times as long as high, and the appendages two thirds as long as the segment.

Length fore-wing 23 to 28 mm., width 6.5 to 7 mm.

Length hind-wing 20 to 25 mm., width 5.5 to 6 mm.

Length abdomen ♀ 17 mm., ♂ 37 to 39 mm.

Specimens examined.—Ariz.: Garcia; Palmerlee, September, October.

HESPEROLEON SACKENI (Hagen).

Plate 1, fig. 12. Plate 3, fig. 48.

Brachynemurus sackeni Hagen, Can. ent., 1888, 20, p. 94.

Interantennal mark small, emarginate below in front, the lower part often as two spots, sometimes a pale spot between antennae; first vertex row a transverse line; second row a few spots near middle, not on sides toward eyes, in middle connected to first row, and two extensions behind; often the spots are more or less indistinct. Last joint of labial palpi moderately swollen, partly brown. Pronotum with four lines, the middle pair close together, and sometimes united in front where they are less broad; the lateral lines rarely reach in front of furrow; in many cases the marks run together, and there is another lateral stripe, but the fine median pale line remains. Rest of notum with brown spots; mesoscutellum always largely pale, two dark spots behind, and sometimes two streaks in front; metascutellum pale, with more or less trace of dark median line. Pleura largely dark; femora and tibiae dotted, spines black, some on front- and mid-femora white. The abdomen is banded, the second segment with pale spot at base, middle and tip, the third, fourth, and fifth segments at middle and tip; in the male the pale is more extensive, but not connected to form a stripe. Wings with the cross-veins dark and usually slightly margined so that there are many small spots, but none prominent; three or four rather larger, one at stigma, one at rhexma, one at end of anal vein, and one on cubitus half-way between the last two; median and cubital veins about half dark, but neither dark at end of every cross-vein; there is sometimes a reddish tinge to the pale of the veins. Hair of abdomen long, mostly black, but some white intermixed.

Vertex considerably elevated, less so in male; pronotum but little broader than long in the middle; hind-spurs little longer than the basitarsus; in fore-wing usually three cross-veins before radial sector, in hind-wings two; radial sector with about nine branches; cubitals have few connected; in hind-wing the cubital fork is usually before radial

sector, but not much difference; abdomen slender, longer than wings, last segment in male very short, hardly one half of preceding segment, the appendages very long, curved, about twice as long as last segment. In hind-wing the hind-margin is convex, first anal vein with about four branches, first five times as long as a cubital cross-vein.

Length fore-wing 16 to 27 mm., width 5 to 8 mm.

Length hind-wing 14 to 24 mm., width 4 to 7 mm.

Length abdomen ♀ 14 to 22 mm., ♂ 20 to 28 mm.

Very common in the West.

Specimens examined.—Calif.: Walters Station; San Diego; Johannesburg; Laguna Beach; Havilah. Ariz.: Wenden, June; Congress; Hot Springs; Prescott. Nev.: Verdi, July; Reno. Utah: Zion's Canyon; St. George, June; Coal Creek, Iron Co. N. M.: Ft. Wingate, June; Jemez Mts., June; Pecos, June. Colo.: South Park; Golden, July. Tex.: Brownwood; Kerrville, April; Dallas (TYPE); Phantom Lake, Davis Mts., June. Also from Beaver Valley, Utah (Brooklyn mus.), Las Cruces, New Mexico (N. M. agric. coll.), Nogales, Oracle, Arizona (Cornell univ.).

It was described from Texas and California.

HESPEROLEON YAVAPAI (Currie).

Plate 1, fig. 3. Plate 4, fig. 82, 91.

Brachynemurus yavapai Currie, Proc. Ent. soc. Wash., 1903, 5, p. 281.

Interantennal mark with a median extension below, first vertex row of three brown spots, second row of three connected spots and connected to middle one of first row (in TYPE with posterior third and longitudinal furrow dark); last joint of labial palpi black, moderately swollen. Pronotum with three dark stripes, the lateral ones ending at furrow (in TYPE all united behind and to posterior marginal spot into one large five-pointed mark); rest of notum mostly dark, scutelli pale with faint median line; pleura more or less brown; legs pale, scarcely marked, tarsi paler than usual (in TYPE the tibiae banded with brown, tips of femora and tarsal joints also dark). Abdomen with a large pale band across middle of dorsal segments, ventral segments pale, but with dark before tip, hair very short, black and white intermixed. Forewings with nearly all cross-veins margined with brown; stigma white, not large, with black spot at inner side, radial sector dark at end of each cross-vein; median vein dark, marked with pale; hind-wings scarcely marked, two or three small clouds in upper tip.

Vertex (in male) but little elevated; pronotum broader than long in middle; hind-spurs barely equal basitarsus; male abdomen short, not equal to hind-wing, appendages as long as last two segments. In fore-wings the cubital fork is before the radial sector (unusual in genus); a few cubital cross-veins connected, but no anals; three or four cross-veins before radial sector, latter with seven or eight branches. In the hind-wings the hind-margin is convex, first anal with about four branches, first long, oblique, fully four times the length of a cubital cross-vein; but one or two cross-veins before radial sector. In both wings the cells between medius and cubitus are very long, especially so in the hind-wings.

Length fore-wing 18 mm., width 4.5 mm.

Length hind-wing 16 mm., width 4 mm.

Length abdomen ♂ 15 mm.

Specimen examined.—Utah: Hurricane, June.

Currie's description is based on a female from Hot Springs, Arizona.

I have before me only a male, which differs considerably from the female TYPE in the marks of vertex, pronotum, and legs; but doubtless they belong together.

HESPEROLEON MACULOSUS (Banks).

Plate 1, fig. 8. Plate 3, fig. 60.

Brachynemurus maculosus Banks, Ent. news, 1899, 10, p. 170.

Interantennal mark small, not below antennae and not much above; first vertex row broken in middle and here connected back to the two submedian spots which form the second row; last joint of labial palpi small, mostly pale. Pronotum with four lines, the middle pair united on posterior part, in front of furrow as two spots, laterals distinct, well separated, and reaching only to furrow. Rest of notum mostly pale, scutelli with median elongate spot; pleura mostly dark; femora and tibia unmarked, spines black. Abdomen with pale stripe each side on base, hair mostly white. Wings with many rather large spots, larger than in *H. abdominalis*, mostly on connections of cross-veins and at forks, median wholly pale, cross-veins more widely separated than in *H. abdominalis*; hind-wings with some spots along subcosta and radius, and at ends of cross-veins.

Vertex much elevated; pronotum much broader than long in middle; hind-spurs fully equal to two joints; in fore-wings three cross-veins before radius, in hind-wings but one, radial sector with seven branches,

no cubitals connected, in fore-wing radial sector a little before cubital fork, in hind-wings the cubital fork a trifle before radial sector, in the hind-wing the radial sector arises much before that point in the fore-wing (unusual in the genus), hind-margin of hind-wings near base slightly convex, first anal with three branches, first much oblique, about five times as long as a cubital cross-vein. Male unknown.

Length fore-wing 17 mm., width 4.5 mm.

Length hind-wing 15 mm., width 4 mm.

The single TYPE specimen from Tehama, California, August, is the only one seen.

HESPEROLEON IRREGULARIS Currie.

Plate 1, fig. 4. Plate 4, fig. 94.

Brachynemurus irregularis Currie, Proc. Ent. soc. Wash., 1906, 7, p. 186.

Interantennal mark brown, emarginate below, with a median projection, above reaching up and including both vertex rows, or the vertex rows separate, a median brown spot behind; last joint of labial palpi scarcely swollen, partly brown; pronotum with a broad brown median stripe, much broader behind, and narrowed at furrow. Rest of notum mostly pale brown, with a few pale streaks or spots, scutelli mostly brown, a black dot on middle of hind-margin; pleura mostly brown; femora and tibiae dotted, spines black. Abdomen yellowish brown, with long black hair above and below. Wings much marked with small brown clouds, but no larger spots nor streaks; stigma yellowish, the cross-veins mostly margined and the forks marked with brown, the median vein mostly dark, and radius dark at end of every cross-vein, a row of brown spots between the subcosta and radius; hind-wings less marked. Vertex considerably swollen; pronotum broader than long in middle, but little narrowed in front; hind-spurs not reaching tip of basitarsus; in both wings the radial sector arises before cubital fork; in fore-wing three or four cross-veins before radial sector, in hind-wings two or three; radial sector with eight or nine branches; several cubitals connected, and several cross-veins before radial sector connected; costal hairs and others very long; hind-margin of hind-wing near base concave, first anal vein with about ten branches, all short and subequal, first hardly twice length of cubital cross-vein above it.

Male unknown.

Length of fore-wing 21 mm., width 5 to 7 mm.

Length of hind-wing 20 mm., width 4 mm.

Length of abdomen ♀ 23 mm.

The only specimen examined is from Havana, Illinois. Currie described it from Columbus, Texas and Havana, Illinois.

HESPEROLEON COQUILLETTI (Currie).

Plate 1, fig. 2. Plate 4, fig. 86, 89.

Brachynemurus coquilletti Currie, Can. ent., 1898, 30, p. 93.

Interantennal mark extending barely below the antennae, often with a median extension below, upward it reaches and includes the first vertex row and often the second; last joint of labial palpi but little swollen, part brown. Pronotum with median stripes united behind, forked in front, and lateral stripes to the furrow, where they are sometimes connected to the median. Rest of notum mostly black, the anterior lobe with two pale spots; scutelli pale, each with a median spot, narrowed behind. Pleura mostly black; femora and tibiae pale, rarely marked, spines black. Abdomen in male with a broad pale stripe each side above, in female less noticeable, hair long, white. Wings with yellowish white stigma, few marks, one at stigma, another at rhexma, both small, smaller marks along radius and cubitus and at forks behind; median vein white, marked only toward tip.

Vertex strongly swollen in female, less so in male; pronotum as broad as long in the middle, not narrowed in front; hind-spurs fully equal to two joints; abdomen of male a little longer than the wings, last segment about twice as long as high, appendages very short, divergent. In fore-wing two or three cross-veins before radial sector, in hind-wings two; radial sector with about seven to ten branches; cubitals rarely connected; in fore-wing second anal simple and usually connected but once to first anal; in hind-wing cubital fork about equal to radial sector; in hind-wings the hind-margin is slightly concave, first anal with three branches, first oblique, and fully three times as long as cubital cross-vein above it.

Length fore-wing 17 to 22 mm., width 4.5 to 6 mm.

Length hind-wing 15 to 19 mm., width 4 to 5 mm.

Length abdomen ♀ 16 to 20 mm., ♂ 26 to 28 mm.

Specimens examined.—N. M.: Jemez Mts.; Mesilla, July; Albuquerque, July. Ariz.: Phoenix, September. Tex.: Brownsville, May. Utah: Vinyard, June; St. George, June; Bellevue, June. Wash.:

Pacoima, July. Calif.: Coronado, July. Also Hamilton Co., Kansas (Snow coll.).

Described by Currie from San Simon, Arizona, and San Bernardino County, California.

In most specimens the last radial cross-vein before stigma is more oblique than usual, and so connected as to appear as a separate radial sector.

HESPEROLEON ABDOMINALIS (Say).

Plate 1, fig. 5, 18. Plate 3, fig. 53, 64.

Myrmeleon abdominalis Say, Godman's west. quart. rept., 1823, 2, p. 163; Ed. Lec., 1, p. 173.

Interantennal mark usually with a median extension below, above usually reaching to first vertex row, second vertex row of a pair of submedian spots, little more. Last joint labial palpi scarcely swollen, mostly pale. Pronotum without median lines in main part, but in front of the groove there is usually a trace of two spots, sometimes very distinct, lateral stripes very distinct, reaching only to the groove. Rest of notum largely pale, in the *juvencus* form clear yellow, the mesonotal lobe more or less spotted, and brown stripes over bases of wings, scutelli with a narrow median spot or line; pleura mostly pale to mostly dark; femora pale to finely dotted, tibiae less marked, spines black. Abdomen with broad pale stripe each side above, in the *juvencus* form this extends more to the tip, in the males the apical segment sometimes shows a transverse middle and basal spot. Wings hyaline to yellowish, with many small brown spots, mostly at ends of the cross-veins and on the forks of marginal vein, median vein normally pale, unmarked, radius dark at each cross-vein, stigma yellow. Hair of abdomen mostly black, but more white below.

Vertex high in both sexes, but more so in the female; pronotum about as broad as long in the middle; hind-spurs equal to about two joints; male abdomen much longer than the wings, last segment from two and a half to three and a half times as long as high, the appendages slender, upcurved, usually about one half to two thirds of last segment. In fore-wings two to four cross-veins before radial sector, in hind-wings two or three; about ten radial branches; usually several cubitals crossed; hind-margin of hind-wings near base scarcely concave but sometimes slightly so, first anal vein with six to nine branches, all short, subequal, the first more than three times longer than the cubital cross-vein above it.

There are two forms which, by themselves, look like separate species and were so named by Hagen. One in the south and southwest, *juvencus*, is rather smaller, much more yellow, the lateral marks on pronotum are very definite, and the two submedian spots in front faint or absent. In the female the hair of abdomen is almost wholly white. In the male the abdomen is rather shorter, the last segment distinctly shorter (although somewhat variable in both series) and the male appendages more than one half of the last segment.

Some specimens from the northeastern states (*salvus* Hagen) are much darker, the pronotal stripes rather indefinite, the median area dark or spotted, the median vein mostly dark, and usually a greater number of branches to first anal; but it grades into the normal form.

Length fore-wing 21 to 27 mm., width 5 to 7 mm.

Length hind-wing 20 to 25 mm., width 4.5 to 5.5. mm.

Length abdomen ♀ 19 to 25 mm., ♂ 25 to 33 mm.

Specimens examined.—Ontario: Go Home Bay, July. Manitoba: Treesbank, July. Mass.: West Chop, August; Lexington; Springfield, July. Conn.: New Haven, July. N. Y.: Rochelle; Sea Cliff, August. N. J.: River Edge, Sandy Hook. Md.: Bay Ridge. D. C.: Washington (TYPE of *salvus*). Va.: Falls Church, June; Virginia Beach, August; Cape Henry, July. N. C.: Southern Pines, May. Ga.: Millen, July; Albany, September. Tex.: Dallas; Waco; Pecos River (TYPE of *juvencus*). Kans.: Onaga. Nebr.: Cambridge; Indianola. N. Dak.: Devils Lake, July. Colo.: Ft. Collins; Clear Creek; Denver; Boulder. N. M.: Las Cruces; Zuni. Utah: Provo; Vinyard, June; Salt Lake, August; Eureka. Ore.: Ashland. Wash.: Seattle; Camp Umatilla, July. Calif.: Gazelle, September; Tehachapi, August; Lathrop, August. Also Milton, Massachusetts, Staten Island and Long Island, New York (Davis), Egg Island, Lakehurst, New Jersey (Brooklyn mus.), Raleigh, North Carolina (N. C. state coll.), Albany, Atlanta, Georgia (Cornell univ.), St. Anthony Park, Minnesota (Minn. state coll.), Clark Co., Kansas (Snow coll.), Oregon, Ontario (Amer. mus. nat. hist.).

HESPEROLEON TENUIS (Banks).

Plate 1, fig. 10.

Brachynemurus tenuis Banks, Trans. Amer. ent. soc., 1899, 25, p. 204.

Interantennal mark not much below antennae, sometimes a median line below, above often connected to the first vertex row, but sometimes with pale between, second vertex row of two rather small submedian

spots; last joint of labial palpi slender, partly dark. Pronotum without median stripes, sometimes faintly indicated in front of the furrow, lateral marks distinct, but reach only to furrow. Rest of notum largely pale, scutelli with median line, spots over base of wings usually broken; pleura pale, with a brown stripe above middle and the lower side brown; femora somewhat dotted, tibiae less so, spines black, some on front- and mid-femora white. Abdomen largely pale on basal part, with dark median line above, sometimes absent, hair long, white, in male mostly black. Wings with dots, but mostly in two longitudinal areas, median pale, many cross-veins also pale; most noticeable spots are a series along radius, and a series (twenty or more) rather larger ones along the cubitus, the forks are more or less dark, the stigma whitish; hind-wings with fainter dots along radius and the cubitus largely dark.

Vertex much elevated; pronotum about as broad as long in the middle, narrowed in front; hind spurs fully equal to two joints. Before radial sector in fore-wings two to five cross-veins, in hind-wings two or three; usually several cubitals connected; in hind-wings cubital fork equal to radial sector; the hind-margin near base slightly concave, first anal with about six branches, short and subequal, first about three times as long as a cubital cross-vein.

Length fore-wing 22 to 24 mm., width 6 to 6.5 mm.

Length hind-wing 20 to 22 mm., width 5 to 5.5 mm.

Length abdomen ♀ 18 mm., ♂ 28 mm.

Specimens examined.—N. M.: Mesilla, June, July. Also Douglas, Arizona (Snow coll.).

SCOTOLEON Banks.

Ent. news, 1913, 24, p. 64.

Similar in most respects to *Hesperoleon*, but the labial palpi are greatly elongated; the legs fairly stout, fifth tarsal joint longer than basal, spurs equal to two joints; abdomen of male but little longer than of female. Costal area of wings simple, Banksian and intercubital lines fairly distinct; second anal of fore-wing runs in a nearly even curve or bends slightly to touch the third, connected twice to third, the second usually simple, the third forked; radial sector in fore-wing much before the cubital fork, in hind-wing often beyond the fork, in hind-wing usually two cross-veins before radial sector; the first anal runs parallel to cubital fork for some distance; second and third anals usually both forked.

TYPE.—*S. longipalpis* Hagen.

SCOTOLEON LONGIPALPIS (Hagen).

Plate 3, fig. 68. Plate 4, fig. 92.

Brachynemurus longipalpis Hagen, Can. ent., 1888, 20, p. 95.

Interantennal mark typically of only a median spot below antennae, but the United States specimens have a spot below each antenna, usually united to form a band; first vertex row of three usually separated spots, second row of four more or less connected spots; pronotum with four stripes, the laterals usually end at furrow in a deep black spot, the submedian pair usually show more or less definitely in front of furrow; rest of notum spotted, largely dark in front, mesoscutellum with two streaks, metascutellum with a large dark spot; pleura mostly dark; femora sometimes more or less infuscated, but often pale and dotted with dark, the hind-femora usually dark toward tip, tibiae usually but little marked. Abdomen more or less narrowly lineate on basal part, hair moderately short, mostly white, but some black above, especially in the male. Wings with distinct dark mark at base of stigma, and a dark, jagged streak (often broken into two or three sections) or a row of spots along cubitus; sometimes a definite mark at rhagma, and at end of the anal. Venation dark, much broken with pale, sometimes many small marks on cross-veins.

Vertex moderately elevated; pronotum scarcely as broad as long in middle, hardly narrowed in front; labial palpi greatly elongated, three times as long as maxillary palpi; hind-spurs almost equal to two joints, spines of legs black; no macrochaetae on front coxae; male abdomen elongate, last segment but little shorter than the preceding, hardly three times as long as high, the appendages pale, divergent, and very short. In fore-wings the radial sector arises before the cubital fork, in the hind-wings usually the opposite; in fore-wings three cross-veins before radial sector, in hind-wings two; radial sector eight to ten branches; hind-margin of hind-wings near base convex, the first anal with six to eight branches, first few long and very oblique, five or six times as long as a cubital cross-vein.

Length fore-wing 19.5 to 26 mm., width 5.5 to 7.5 mm.

Length hind-wing 17 to 23 mm., width 4.5 to 6.5 mm.

Length abdomen ♀ 17 to 22.5 mm., ♂ 25 to 30 mm.

Specimens examined.—Calif.: San Bernardino; Salt Well Valley, Kern Co.; Claremont. Nev.: Humboldt Station, July (TYPE); Reno. Ariz.: Nogales, July; Phoenix, August; Yuma; Hot Springs, July. N. M.: Mesilla, July; Albuquerque. Utah: Bellevue. Tex.: Davis

Mts., June; Marfa, June. Also Nogales, Oracle, Arizona (Cornell univ.), Utah (Brooklyn mus.).

There were eight types, six from Cape St. Lucas, Baja California, and two from Humboldt Station, Nevada. The Baja specimens (which should be types in case of division) have no marks below antennae, but a definite median spot below. In all the United States specimens the median mark is at best barely indicated by a line, but there is a band (or two spots) below antennae. Sometimes these spots are almost absent (Arizona) but the median spot is also absent. The Baja specimens have the hind-tibia simply dotted; in most of the United States specimens the hind-tibiae are dark over part or all of the apical half. In some San Bernardino specimens however the hind-tibiae are dotted. In some Arizona specimens the dark along cubitus is continuous. There is some variation in the length of the labial palpi; the Baja specimens have the enlarged part of last joint fully as long as the stem, while in some of the United States specimens the stem is plainly longer.

NETRONEURUS, gen. nov.

Second anal of fore-wing runs in even curve, not bent toward first anal; the radial sector before cubital fork in fore-wings, and may be also in hind-wings, about two cross-veins before radial sector in hind-wings; the first anal in hind-wings runs for some distance parallel to cubital fork; front-coxae with several curved macrochaetae, and a series of similar bristles above on front-femur; spurs about as long or little longer than basal joint.

TYPE.—*N. carolinus* Banks.

The two species may be separated as follows:—

1. Abdomen (♀) longer than wings; hind-femora dotted all over; cubitals connected; larger, eastern species.....*carolinus*.
2. Abdomen (♀) shorter than wings; hind-femora with dots forming a band near tip; few of any cubitals connected; smaller, western species; wings more spotted.....*pulchellus*.

NETRONEURUS CAROLINUS Banks.

Plate 1, fig. 21. Plate 3, fig. 74.

Brachynemurus carolinus Banks, Trans. Amer. ent. soc., 1911, 37, p. 349.

Interantennal mark with a median line down to clypeus, where there is a transverse mark, upward it extends but a little, usually not reach-

ing the first vertex row, the latter of two long curved lines, second vertex row of large, not very definite submedian spots; last joint of labial palpi but little swollen, partly pale. Pronotum with indistinct marks; a median line, in front of it two spots; a narrow lateral stripe reaching to furrow, and outside this several more or less distinct marks. Rest of notum much marked, mesoscutellum with two streaks, and two shining black spots at base, metascutellum with a large spot; spots over base of wing much broken; pleura mostly dark; femora much dotted, tibiae hardly less so. Abdomen with two or three basal segments usually pale, dark at tip, beyond dark; hair long, mostly black.

Vertex much elevated; pronotum about as long in middle as broad, narrowed in front; front-coxae with some long curved white macrochaetae; and a crest of similar macrochaetae above on front-femora, most of other leg spines black; hind-spurs equal about one and one half joints. Abdomen of female longer than wings, that of male much longer, last segment nearly five times as long as high; appendages long slender, little curved, not one half as long as the last segment. Wings but little marked, venation interrupted with dark; in fore-wings three cross-veins before radial sector (sometimes all connected), in hind-wings two cross-veins; several cubitals connected; in hind-wings the radial sector is usually much before the cubital fork; hind-margin toward base faintly concave, first anal with eight to ten branches, short and subequal, the first not three times as long as a cubital cross-vein.

Length fore-wing 20 to 22 mm., width 4.8 to 5.9 mm.

Length hind-wing 19 to 20.5 mm., width 3.8 to 4.7 mm.

Length abdomen ♀ 20 to 22 mm., ♂ 31 to 32 mm.

Specimens examined.—N. C.: Southern Pines, June (TYPE). Ga.: Millen, July. Fla.: Gotha, April.

NETRONEURUS PULCHELLUS Banks.

Plate 2, fig. 25.

Brachynemurus pulchellus Banks, Trans. Amer. ent. soc., 1911, 37, p. 348.

Interantennal mark covering most of face below and upward to first vertex row, second vertex row a narrow transverse line, with a curved mark each side behind; last joint of labial palpi much swollen, mostly dark. Pronotum with the usual four lines, the middle pair well separated throughout, the laterals connected, except at tip to the median, thus forming a broad stripe each side with a pale spot in front, outside

of these stripes there is a streak in front and a dot behind. Rest of notum mostly dark, mesoscutellum with two streaks and an elongate median spot behind, metascutellum mostly dark; brown over base of wings with two pale dots; pleura largely dark, sutures marked with pale; femora dotted, hind pair with band before tip; front- and mid-tibiae with mark near base and toward tip, hind-tibiae with elongate spots below. Abdomen dark, last segments with small median and apical pale spots. Wings with veins largely dark, but white in streaks and some cross-veins wholly white, stigma with large dark spot at base, short oblique stripe up from rhagma and at end of anal, several along cubitus, and some radial cross-veins margined. Hair of abdomen white.

Vertex of female but little elevated; pronotum not as broad as long in middle; front-coxae with large curved macrochaetae, also similar white macrochaetae above on front-femora, spines largely white, but some black; hind-tibiae longer than hind-femora, hind-spurs barely if any longer than basal joint. Abdomen of female shorter than wings, male unknown. In fore-wings three cross-veins before radial sector, in hind-wings two; no cubitals connected; in hind-wing radial sector about equal cubital fork; hind-margin near base hardly concave, first anal with four or five branches, all short and subequal, first hardly three times as long as a cubital cross-vein.

Length fore-wing 13.5 mm., width 3.6 mm.

Length hind-wing 12 mm., width 2.7 mm.

Length abdomen ♀ 12 mm.

Only specimen seen is the TYPE from Brown, California, October.

BRACHYNEMURUS Hagen.

Can. ent., 1888, 20, p. 34.

Last joint of labial palpi but little swollen; antennae moderately long, clavate; pronotum usually broader than long; legs rather slender, fifth tarsal joint the longest, spurs usually equal to two tarsal joints; abdomen of male much longer than in the female, longer than the wings. Fore-wings with costal area two-celled for at least one half-way; radial sector before cubital fork; second anal runs in even curve, connected twice to the third, both second and third usually forked; the Banksian and intercubital lines fairly distinct. In hind-wings usually two cross-veins before the radial sector, this usually before cubital fork; the first anal runs for some distance parallel to the cubital fork, and connected thereto by several cross-veins; Banksian and inter-

cubital lines rather less distinct than in fore-wings; second and third anal both forked.

TYPE.—*B. longicaudus* Burmeister.

The Nearctic species four in number are easily separated as follows:—

1. Vertex elevated angularly each side, concave in middle; anterior lobe of mesonotum conically elevated each side; pronotum broader than long; antennae short; spines on legs very short; spurs not equal to basitarsus.

tuberculatus.

Vertex evenly convexly elevated; pronotum as long or longer than broad; antennae elongate; spines long; spurs longer than basitarsus 2

2. Pronotum with a continuous pale median stripe; two dark spots on clypeus; hair on abdomen with much white intermixed; western species.

elongatus.

Pronotum with pale stripe only on anterior part if at all; hair on abdomen mostly dark; eastern species 3

3. At least six of radial cross-veins with large dark clouds as broad as high, also large spots at rhagma, end of anal and along the cubitus, and at rhagma in the hind-wings *ramburi.*

The spots on radial cross-veins are much smaller, not half as wide as high, nor any large spots elsewhere *longicaudus.*

BRACHYNEMURUS LONGICAUDUS Burmeister.

Plate 2, fig. 28. Plate 3, fig. 70.

Myrmeleon longicaudus Burm., Handb. ent., 1839, 2, p. 994.

Interantennal mark, often not very dark, extending obliquely below antennae and sometimes with a median line below, above sometimes reaching first vertex row, usually not, vertex mostly dark, the rows more or less run together. Last joint of labial palpi but little swollen, partly brown. Pronotum with marks often indistinct, usually a very broad median stripe, with pale spots in front of furrow; laterally the pronotum has a dark streak often merging with the brown. Rest of notum largely brown, with pale, more or less indistinct spots, scutelli largely dark; pleura mostly dark; femora dotted, tibiae less so, all with long hair and spines, the latter mostly black, but some white especially on front-femora; front-coxae with several macrochaetae. Abdomen mostly dark, but with more or less definite pale stripe each side above on basal part, in male sometimes entire basal segments pale, hair long, black. Wings but little marked, spots at rhagma and along cubitus, and at end of anal sometimes more distinct; venation mostly dark.

Vertex moderately elevated, emarginate in middle, rather concave between the two vertex rows; pronotum longer than broad; sides of anterior lobe of mesonotum roundedly humped; spurs nearly equal two tarsal joints, front-tarsus longer than front-tibia. Abdomen of male exceedingly long, slender, last segment fully four times as long as high, appendages short, divergent, hardly as long as height of segment.

Wings rather broad; two series of costal cells more than one half-way to base; in both wings radial sector before cubital fork, but not much so in hind-wings; in fore-wings three cross-veins before radial sector, in hind-wings two; nine or ten branches to radial sector; several cubitals connected; hind-margin of hind-wings slightly concave, first anal vein with eight to ten branches, short and subequal, first not three times as long as a cubital cross-vein; hairs of wing rather long and very numerous.

Length fore-wing 21 to 23 mm., width 4.9 to 6 mm.

Length hind-wing 20 to 22 mm., width 4.2 to 5.2 mm.

Length abdomen ♀ 22 to 23 mm., ♂ 35 to 36 mm.

Specimens examined.—N. J.: Lakehurst. N. C.: Southern Pines, June. Ga.: Millen, July; St. Simon's Isl., September. Fla.: Ormond; Cedar Keys; Crescent City; Gotha, July. *Also* St. Simon's Island, Georgia (Cornell univ.) Beaufort, North Carolina (N. Car. state coll.), Florida (Brooklyn mus.).

BRACHYNEMURUS RAMBURI Banks.

Plate 3, fig. 58.

Brachynemurus ramburi Banks, Cat. Neurop., 1907, p. 31.

Interantennal mark hardly below antennae, sometimes a median extension, and a mark across at base of clypeus, above the mark usually extends over vertex, sometimes the vertex spots are more separated, usually some pale each side near eye, behind is an oval brown spot. Last joint of labial palpi but little swollen, mostly brown. Pronotum largely brown, obscurely marked, three pale spots in front, sometimes one each side near middle. Rest of notum mostly dark; the scutelli pale, with a median dark line; pleura mostly dark; femora spotted, tibia less so, spines mostly black, some white ones on front-femora, front-coxae with several white macrochaetae. Abdomen mostly dark, some of basal segments sometimes largely pale, with dark tips, most noticeable in male; hair black. Wings heavily spotted,

about twelve or fourteen large spots, one each side of stigma, about six just above radial sector, one at rhagma, usually two others along cubitus, and one at end of anal. Venation mostly dark, but more white in places than in *B. longicaudus*, many cross-veins narrowly margined and small spots at forks; in hind-wings the cross-veins slightly margined, and the rhagma usually marked.

Vertex moderately high; pronotum longer than broad; front-spurs more than two joints, hind-spurs nearly two joints; the anterior lobe of mesonotum is hardly as plainly humped as in *longicaudus*; male abdomen very long (as in *longicaudus*), last segment about three to three and one half times longer than high, the appendages equal height of segment, rather longer than in *longicaudus*.

Wings fairly broad; double costal series reaching more than one half-way to base; before radial sector in fore-wings three cross-veins, in hind-wings, two; about nine branches to radial sector, usually a few cubitals connected; in both wings radial sector before cubital fork, but little so in hind-wings; hind-margin of hind-wings faintly concave, first anal with eight to ten branches, short and subequal, the first not three times as long as cubital cross-vein above; hair on wings rather long and abundant. Structurally very similar to *B. longicaudus*.

Length fore-wing 21 to 24 mm., width 5 to 6.5 mm.

Length hind-wing 20 to 22 mm., width 4.5 to 5.2 mm.

Length abdomen ♀ 23 to 25 mm., ♂ 35 to 37 mm.

Specimens examined.—N. C.: Southern Pines, May. Ga.: Millen, July. Fla.: Gotha, April. Also Chester, Georgia (Cornell univ.).

BRACHYNEMURUS ELONGATUS Banks.

Plate 1, fig. 15. Plate 3, fig. 57.

Brachynemurus elongatus Banks, Trans. Amer. ent. soc., 1904, 30, p. 105, pl. 1, fig. 10.

Interantennal mark extending obliquely below antennae on each side, above not reaching up on vertex, often with a pale dot between the antennae, two dark spots on the clypeus, first vertex row a continuous line, second vertex row of several more or less connected spots, and behind in middle is an oval brown spot. Last joint of labial palpi but little swollen. Pronotum with four stripes, the median pair well separated, the laterals united near middle and at tip, thus leaving two pale spots each side, laterally there is another stripe. Rest of notum much spotted, mesoscutellum with two streaks, metascutellum

with a large double mark; pleura mostly dark; femora much dotted, tibiae also much marked, but hind-tibia mostly below, spines long mostly black, but some long white ones on femora, front-coxae with several macrochaetae. Abdomen above often all dark, in some with a few pale spots and streaks above on basal part, in male with a long pale stripe each side above, hair fairly long, mostly black, but some white intermixed. Venation mostly dark, interrupted with pale, radius with long streaks of pale, a large black spot at base of stigma, a line up from rhexma, less distinct at end of anal, and several marks along cubitus, marginal forks also dark, median vein mostly dark.

Vertex high, but evenly convexly elevated; pronotum not as broad as long in the middle; front-spurs equal two joints, hind-spurs longer than basal joint. Male abdomen very much longer than wings, last segment five times as long as high, appendages short, divaricate. Wings moderately narrow; costal series double for usually one half-way, in fore-wings three cross-veins before radial sector, in hind-wings two, eight to ten branches of radial sector, usually a few cubitals connected, in both wings radial sector before cubital fork, in the hind-pair but slightly so; hind-margin of hind-wings scarcely concave, first anal with about ten branches, none long, but first three or four times as long as a cubital cross-vein, rather longer than usual in the genus; hair on wing, especially costal hair, short.

Length fore-wing 23 to 25 mm., width 6 to 6.5 mm.

Length hind-wing 20 to 22 mm., width 5 to 5.5 mm.

Length abdomen ♀ 20 to 21 mm., ♂ 36 mm.

Specimens examined.—N. M.: Mesilla (TYPE); Las Vegas, July. Ariz.: Prescott. Colo.: Golden; South Park; Platte Canyon; Berkeley. Utah: St. George, June.

BRACHYNEMURUS TUBERCULATUS Banks.

Plate 3, fig. 69, 72.

Brachynemurus tuberculatus Banks, Can. ent., 1899, 31, p. 70.

Interantennal mark large, extending across below antennae and with a median line below, upward it connects with the dark of the vertex. Back of each vertex tubercle is a pale area, and in middle behind a velvety black spot crossed by a faint median line. Pronotum with the stripes more or less united to form one broad stripe, with two pale spots in front; laterally there is a dark streak. Rest of notum mostly dark, a few pale spots, scutelli mostly black, the mesoscutellum

with faint median line; pleura largely dark; femora becoming black toward tip, tibia with dark marks before middle and near tip, spines mostly black, all very short, none on femora as long as width of joint, front-coxa with one white macrochaeta. Abdomen dark, with a small pale spot near middle and sometimes one each side near tip of several segments, hair fairly long, mostly dark, but much white intermixed. Wings little marked; venation mostly dark, interrupted with pale, many cross-veins with dark dot in middle, median vein mostly dark, dark spot at base of stigma, a line up from rhagma, and less distinctly at end of anal.

Vertex much elevated, each side back of the antennae in a cone, between them the ridge is concave; pronotum broader than long in middle; each lateral corner of anterior lobe of the mesonotum elevated conically and the tip with a group of stiff short bristles; spurs short, not equal to basitarsus. Abdomen of female shorter than hind-wings; in male but little longer, last segment scarcely as long as high, appendages slender, more than twice as long as last segment, down-curved, much divergent at base, below with spines, outside with fine hair.

Wings rather narrow; in fore-wings three cross-veins before radial sector, in hind-wings two; about eight branches to radial sector; the crossed costals reach more than one half-way to base; in both wings the radial sector arises before cubital fork, but less so in the hind-wings; hind-margin of hind-wings near base slightly concave, the first anal with six to eight branches, short and subequal, the first about twice as long as a cubital cross-vein.

Length fore-wing 14.5 to 21 mm., width 3.3 to 5 mm.

Length hind-wing 14 to 19 mm., width 2.9 to 4 mm.

Length abdomen ♀ 15 to 16 mm., ♂ 16 mm.

Specimens examined.—N. M.: Mesilla (TYPE). Ariz.: Santa Rita Mts., July.

CALINEMURUS Banks.

Can. ent., 1899, 31, p. 70.

Last joint of labial palpi much swollen; antennae moderately long, clavate; pronotum fully as long as broad; legs rather slender, the hind-tibia longer than the femur, basal tarsal joint much shorter than the fifth, spurs as long as basal joint or more; abdomen of female scarcely as long as wings, in male longer. Fore-wing with costal area two-celled most of way, sometimes partly three-celled, in hind-wings sometimes two-celled for a short distance near stigma; radial sector

before cubital fork in both wings; Banksian line distinct, intereubital line rather less so; four to six cross-veins before radial sector in fore-wing, two to four in hind-wing, usually several are connected; in fore-wing the second anal runs in even curve, but usually touches the third at one point, two or three cross-veins to third, both second and third usually forked; in hind-wings the first anal runs parallel to cubital fork, and is connected thereto several times; the second anal forked, the third usually simple; much of the venation in both wings is irregular.

TYPE.—*C. californicus* Banks. Mexico.

CALINEMURUS FUSCUS Banks.

Plate 4, fig. 100.

Calinemurus fuscus Banks, Trans. Amer. ent. soc., 1906, **32**, p. 6.

Interantennal mark large, extending much below antennae and straight across, first vertex row a nearly continuous line, second more broken; last joint labial palpi slightly swollen, partly brown; antennae brown. Pronotum almost wholly dull brown, a median pale line, and one or two lines on the sides; rest of notum mostly dark, with some pale spots, mesoscutellum with a pair of pale submedian spots, and lateral corners pale, metascutellum mostly dark; pleura almost wholly dark; femora and tibiae heavily dotted, the spots sometimes confluent, spines mostly black, some white ones, a row of white ones above on front-femur, and a series of white macrochaetae on front-coxae. Abdomen with basal segments slightly lineate above pale, densely long-haired, almost wholly dark. Venation mostly dark, and often slightly bordered with dark, larger dark spots at base of stigma, up from rhcgma, several along cubitus, and one at end of anal; space between radius and subcosta fumose.

Vertex moderately elevated; pronotum hardly broader than long in middle, not narrowed in front; front spurs about one and one half joints, hind-spurs little longer than basitarsus; abdomen of male a little longer than hind-wings, last segment hardly twice as long as high, the appendages long, upcurved, rather longer than last segment. Wings long and slender; venation very dense; in fore-wings three series of costal cells for most of distance, in hind-wings two series for two thirds of distance; in both wings radial sector much before cubital fork, in fore-wings five to eight cross-veins before radial sector, several connected, in hind-wings two or three, partly connected; about thirteen branches to radial sector; cubital cross-veins mostly connected;

in hind-wings the hind-margin near base is hardly concave, the first anal vein with about ten or eleven branches, the first about four times as long as a cubital cross-vein; hairs on veins rather short, but very numerous.

Length fore-wing 28 mm., width 6.8 mm.

Length hind-wing 25.5 mm., width 5.5 mm.

Length abdomen ♂ 27 mm.

Ariz.: Nogales, July (TYPE).

CLATHRONEURIA Banks.

Ent. news, 1913, **24**, p. 64.

Last joint of labial palpi much swollen; antennae moderately short, rather strongly clavate; pronotum broader than long; legs fairly stout, fifth tarsal joint much longer than first, spurs equal to two joints. Abdomen in both sexes longer than the wings, in male much longer than in female. Costal area of wings simple; radial sector in fore-wings before the cubital fork, in hind-wings usually so; second anal of fore-wing runs in even curve, connected but once to the third, the second usually simple, the third usually forked. In hind-wing two cross-veins before radial sector; first anal bends down to the margin near cubital fork, usually both the second and third anals forked.

TYPE.—*C. schwarzi* Currie.

The two species may be separated as follows:—

1. Pronotum with median as well as lateral stripes or marks; abdomen with pale at base and apex of segment.....*schwarzi*.
Pronotum with only the lateral marks; abdomen with pale only at tips of segments.....*delicatulus*.

CLATHRONEURIA SCHWARZI (Currie).

Plate 4, fig. 79, 99.

Brachynemurus schwarzi Currie, Proc. Ent. soc. Wash., 1903, **5**, p. 280.

Interantennal mark of moderate size, rather emarginate below, first vertex row of three brown spots, second row of four spots, in middle behind is a brown spot; last joint of labial palpi not much swollen, mostly pale; antennae pale, dark near tip. Pronotum with four or six brown stripes, the submedian pair broad, reaching to front, and close together, sometimes almost united in part, lateral stripes end at furrow, and outside usually another, shorter stripe; rest of notum much

marked with brown; a double stripe on mesoscutellum, and double spot on the metascutellum; pleura spotted, but about half pale; femora mostly dotted, tibiae with subbasal and preapical dark marks, spines rather long, many black, but some white ones; abdomen banded with pale at base, middle, and apex of segments, sometimes apical part is darker, hair quite long, largely black, but white in patches. Wings with pale venation, the cross-veins and connections nearly all dark brown, and often faintly bordered, no large dark marks, stigma white.

Vertex considerably elevated; antennae short, strongly clavate; pronotum about as long in middle as broad, but little narrowed in front; front-spurs equal three joints, hind-spurs equal two joints; abdomen in female as long as hind-wings, in male very much longer, last segment about four times as long as high, appendages moderately long, fully one half as long as last segment, curved near base and outwardly near tip.

In both wings the radial sector arises a little before cubital fork; in fore-wings three cross-veins before radial sector, in hind-wings two; about eight branches to radial sector; several cubitals connected; last radial cross-vein very oblique; hind-margin of hind-wings slightly concave, first anal vein with about four, short, subequal branches; hairs on veins rather long.

Length fore-wing 21 to 26 mm., width 5 to 7.5 mm.

Length hind-wing 18.5 to 23 mm., with 4.5 to 6.5 mm.

Length abdomen ♀ 22 to 24, ♂ 30 to 39 mm.

Specimens examined.—Calif.: San Gabriel Mts., September. Ariz.: Palmerlee. Utah: Eureka, July; Stockton, August. N. M.: La Luz, August; Jemez Mts., July.

Currie described it from Flagstaff and Williams, Arizona.

CLATHRONEURIA DELICATULUS (Currie).

Plate 2, fig. 30.

Brachynemurus delicatulus Currie, Proc. Ent. soc. Wash., 1903, 5, p. 279.

Interantennal mark with a short median extension below, a yellow spot just above the antennae; vertex dark, a pair of pale spots at middle of hind-border, and less distinct spots on sides and front. Antennae dark, basal joint pale; palpi dark; pronotum pale, a pair of dark stripes, broad and approximate behind, narrowed and widely separate in front, and end in the furrow; rest of notum dark, spotted with pale; pleura

with yellowish spots; legs pale, unmarked, with black and some white spines. Abdomen dark, a pale line each side, and tips of the segments pale. Wings not marked, except dark at base of stigma; venation pale and dark. Spurs equal four joints; male abdomen longer than wings, appendages very short; wings slightly falcate at tip; second and third anals of fore-wings not forked, connected once; hind-wing with hind-margin concave near base, first anal with two or three short branches.

Length ♂ 18 mm., expanse 33 mm., width fore-wing 4.3 mm.¹

Phoenix, Arizona, May.

AUSTROLEON Banks.

Journ. N. Y. ent. soc., 1909, **17**, p. 3.

Last joint of labial palpi swollen; antennae very short, clavate; pronotum a little longer than broad, or broader than long; legs rather stout, basal tarsal joint much shorter than the apical, spurs equal to one or more joints, front-coxae and front-femora above with a comb of long curved white bristles. Abdomen shorter than wings, in male longer. Wings rather narrow, acute at tips, costal area simple, radial sector usually before cubital fork in both pairs, second anal in fore-wing runs in a nearly even curve, with one short cross-vein to the third or touching the third; second anal forked, third usually forked. In hind-wing both second and third anals are forked, the first anal bends down to margin near cubital fork. Before radial sector in fore-wing three cross-veins, in hind-wing two; Banksian and intercubital lines faint or absent.

TYPE.—*A. dispar* Banks. South America.

Three Nearctic species are referable to this genus which is better represented in South America.

1. Three shining black spots on the mesoscutellum; abdomen somewhat transversely banded with pale; wings broad, spots between radius and subcosta..... *tripunctatus*.
Not three shining spots on scutellum; the abdomen more lineate; wings narrow, less spotted, no marks between radius and subcosta.....²
2. Pronotum pale through a broad middle area, dark on sides; front-spurs equal to three tarsal joints..... *dorsalis*.
Pronotum dark, with three pale lines; labial palpi about twice as long as maxillary palpi; front-spurs equal to four tarsal joints..... *barberi*.

¹ Description mostly from Currie.

AUSTROLEON DORSALIS (Banks).

Plate 1, fig. 22. Plate 4, fig. 83.

Brachynemurus dorsalis Banks, Journ. N. Y. ent. soc., 1903, 11, p. 240.

Interantennal mark a little above and below antennae, usually including a pale transverse spot just above antennae; vertex wholly dark, rarely showing distinction into two rows; palpi pale. Pronotum with a broad pale median area, dark on the sides; rest of notum mostly dull black, the scutelli usually with large median mark, pleura much spotted with dull black; femur of front-pair mostly dark above, others dotted, and with large spot toward tip, tibiae with subbasal and apical mark, hind-tibiae somewhat lineate below. Abdomen lineate with pale, especially with the male on basal part, but toward tip with pale median spot on segments above. Wings scarcely marked, a faint spot at rhexma and at end of anal; veins pale, interrupted with dark, cross-veins usually more or less dark. Hair of abdomen white; spines on legs mostly white.

Vertex considerably elevated; antennae short, strongly clavate; pronotum longer than broad, rather narrowed in front; legs short, front-femora plainly longer than tibiae; a row of bristles on femur above and several bristles on front-coxae; hind-spurs equal two joints; male abdomen much longer than hind-wings, last segment six or more times as long as high, appendages pale, short, divergent, about as long as height of segment. In both wings the radial sector before cubital fork; in fore-wings three cross-veins before radial sector, in hind-wings two; about seven branches of radial sector; last connecting veinlet between radius and radial sector is heavier and more oblique than the others so that it appears like an extra radial sector; hind-margin of hind-wing near base concave, first anal with about five branches, all short and subequal.

Length fore-wing 17 to 20 mm., width 4 to 5 mm.

Length hind-wing 15 to 18 mm., width 3 to 4 mm.

Length abdomen ♀ 18 to 20 mm., ♂ 25 to 28 mm.

Specimens examined.—Tex.: Laredo (TYPE); Mercedes, July; Dallas; Brownsville, May; Sabinal, September; Hondo.

The *Brachynemurus curriei* of McClendon grades into *dorsalis*.

AUSTROLEON BARBERI (Currie).

Plate 2, fig. 24.

Brachynemurus barberi Currie, Proc. Ent. soc. Wash., 1903, 5, p. 282.

Interantennal mark small, a median extension to clypeus. Vertex dark, a band in front pale, vertex rows shining fuscous. Antennae dark, with narrow, pale annulations. Labial palpi about twice as long as maxillary, dark brown. Pronotum dark, with three pale lines, one median and two lateral ending in the furrow; rest of notum dark, with a few pale spots. Legs with femora mostly dark, and dark bands on tibiae, spines black, but many white ones, those on front-femora above long and white. Abdomen with indistinct pale spots on middle of segments. Wings with few dark spots, mostly along cubitus, a dark spot at base of whitish stigma, and an oblique streak up from rhexma. Pronotum longer than broad; spurs as long as first four tarsal joints in front-legs, as long as first three in other legs. Wings shorter than abdomen, narrow; in fore-wings the second anal is not forked, is connected but once to the third anal which is forked.

Length ♀ 23 mm., expanse 38 mm., width fore-wing 4.3 mm., Hot Springs, Arizona, June (Barber and Schwarz).¹

AUSTROLEON TRIPUNCTATUS (Banks).

Hesperoleon tripunctatus Banks, Can. ent., 1922, 54, p. 60.

Interantennal mark rather large above and below antennae, but not reaching up on the vertex, first vertex row a continuous line, second of several spots, the largest lateral, and a median spot behind; labial palpi with tip much swollen and partly dark; pronotum with four spots in front, a long median mark behind and lateral stripes, the long median mark more or less divided; rest of notum with large dark spots, tip of mesoscutellum with three shining black spots, one on the metascutellum, bristles on thorax large, some white; pleura largely dark; the femora and tibiae much dotted, long spines on legs mostly white, front-coxae with white macrochaetae, and a row of similar ones above on femur; abdomen with rather irregular pale marks at base and middle of segments, hair mostly black, but white on pale areas. Wings much spotted with small marks, some between subcosta and radius, larger at rhexma and end of anal; many cross-veins wholly dark; veins white, with dark streaks.

Vertex moderately elevated; antennae rather short, strongly capitate; pronotum a little longer than broad, hardly narrowed in front;

¹ Description mostly from Currie.

legs rather short, femur of front-pair rather longer than tibia, hind-spurs about equal to one and one half joints; abdomen nearly as long as hind-wings. In both wings the radial sector arises much before the cubital fork; in fore-wings three cross-veins before radial sector, in hind-wings but one; seven branches to radial sector; hind-margin of hind-wings near base concave, first anal with five or six branches, all short, subequal; hair on wings rather long.

Length fore-wing 22 to 25 mm., width 6 to 7.5 mm.

Length hind-wing 20 to 23 mm., width 5.5 to 6.5 mm.

Length abdomen ♂ 23 mm.

Specimens examined.—Ariz.: Palmerlee, June, July (TYPES).

At first the species looks much like *Hesperoleon sackeni*; it is rather abnormal for *Austroleon*, and may yet form a new genus.

CHAETOLEON Banks.

Bull. M. C. Z., 1920, 64, p. 328.

Last joint of labial palpi swollen; antennae long, with almost capitate tip; pronotum longer than broad. Legs very slender, the front-tibia is equal to front-femur, latter with a crest of long white bristles, and also comb on front-coxae, spurs about equal to two joints; mesonotum with some enlarged, fusiform bristles above. Abdomen shorter than hind-wings. Wings rather narrow, acute at tips; in fore-wings the costal area simple; radial sector before cubital fork in both pairs; second anal runs in even curve, and then unites with the third anal for short distance; both the second and third anals forked. In hind-wings the first anal bends down to margin near forking of cubitus; before the radial sector in fore-wing three cross-veins, in hind-wings two; Banksian and intercubital lines faint or absent.

TYPE.—*C. pumilis* (Burmeister).

The two closely related species can be separated as below:—

1. Pronotum black, except anterior lateral angles, rest of notum mostly black; fore-wings rather heavily marked. *pumilus*.
Pronotum much marked with pale, as also the rest of the notum; wings less marked. *pusillus*.

CHAETOLEON PUMILIS (Burmeister).

Plate 2, fig. 40.

Myrmeleon pumilus Burm., Handb. ent., 1839, 2, p. 995.

Interantennal mark large, much below antennae, and extending up to first vertex row and often to the second, usually a pale spot each side

below the first vertex row; palpi mostly pale; antennae annulate, tip dark; pronotum largely dark, usually only anterior corners pale; rest of notum almost wholly dark, sometimes a pale spot above fore-wing; large heavy enlarged spines on mesonotum; pleura mostly dark; femora largely dark, tibiae with subbasal and apical dark bands, spines long, partly white; abdomen with pale spot in middle of segments, or at least the basal ones. Wings with about a dozen fairly large spots, several between subcosta and radius, and continued on the cross-veins behind, one at rhagma, three others along cubitus, and one at end of anal, a few other smaller marks, mostly at forks of veins.

Vertex moderately elevated; pronotum longer than broad; legs very slender; tibiae fully equal to femora, and much longer than tarsi, hind-spurs equal to two joints, a comb of white bristles on front-coxae, and above on front-femur; abdomen of male short, not as long as hind-wings, the short, pale appendages sometimes apparent; hair of abdomen mostly white. In both wings the radial sector arises before cubital fork; in fore-wing three cross-veins before radial sector, in hind-wing but two; about six branches to radial sector; hind-wing with the hind-margin near base concave, the first anal with four to six branches, all short and subequal; hairs on wing rather long.

Length fore-wing 15.5 to 17.5 mm., width 4 to 4.5 mm.

Length hind-wing 15 to 16.5 mm., width 3 to 3.5 mm.

Length abdomen ♀ 12.5 to 15 mm., ♂ 14 mm.

Specimens examined.—South Carolina (TYPE). N. C.: Southern Pines, May, June. Ga.: Millen, July. Fla.: Lake Worth. Also Florida (Brooklyn mus.).

CHAETOLEON PUSILLUS (Currie).

Plate 2, fig. 27.

Brachynemurus pusillus Currie, Can. ent., 1899, **31**, p. 363.

Interantennal mark a little below and above antennae; first vertex row a continuous line; second close to it of a lateral spot and a median connection, and a median spot behind; palpi mostly pale; antennae pale, ringed with dark and darker at tip; pronotum with four spots in front, the submedian pair larger and nearly touching, behind them a long median spot, sometimes with median pale line, several lateral spots; rest of notum much spotted, the scutelli with large median spot, sometimes small lateral ones; pleura much spotted; front-femora mostly dark above, other femora with preapical band, all tibiae with subbasal and apical bands. Abdomen with pale irregular spots

on middle and tip of several segments; thorax with many long mostly white bristles, some on the mesonotum black and much thickened; hair on the abdomen white, moderately long. Wings with several spots between subcosta and radius, one at base of stigma, elongate one at rhagma, and several above cubitus, and one at end of anal, small marks on forks and on some cross-veins, veins mostly white with long streaks of dark.

Vertex moderately elevated; pronotum longer than broad; legs very slender, femur not longer than tibiae, hind-tibia much longer than tarsus, hind-spurs about equal to two joints; spines long, mostly white, front-coxae with curved macrochaetae and a row of similar ones above on front-femur. In both wings the radial sector arises much before cubital fork; in fore-wings three cross-veins before radial sector, in hind-wings two; about six branches to radial sector; hind-margin of hind-wings near base slightly concave, the first anal with five branches, short and subequal; hair on wings rather long. Abdomen of male no longer than female, much shorter than hind-wings, appendages not projecting.

Length fore-wing 14 to 18 mm., width 3.5 to 5.5 mm.

Length hind-wing 13 to 16.5 mm., width 2.9 to 4 mm.

Length abdomen ♀ 12 to 15 mm., ♂ 14 mm.

Specimens examined.—N. M.: Mesilla Park; Las Cruces. Utah: Parowan Canyon; Coal Creek, Iron Co., June; Eureka, July. Also Santa Rita Mts., Arizona (Snow coll.). Currie described it from Ft. Grant, and Madera Canyon, Santa Rita Mts., Arizona.

MARACANDULA Curtie.

Proc. Ent. soc. Wash., 1901, 4, p. 436.

Last joint of labial palpi but little swollen; antennae short, capitate; pronotum rather longer than broad; legs slender, basal tarsal joint longer than the fifth, claws small, spurs absent; abdomen short in both sexes, and shorter than wings. Wings rather short and broad; costal area simple; radial sector in both pairs before the cubital fork; neither Banksian nor intercubital lines; second anal runs in even curve and is connected twice to the third anal. In hind-wing one to three cross-veins before radial sector, and the first anal bends down to the margin near cubital fork, usually both second and third anals are forked.

TYPE.—*M. pygmaea* (Hagen). Mexico.

The generic characters were drawn from *bellula*; when *pygmaea* is better known a new genus may be required. Most of the characters

apply to that species, but the apical tarsal joint is longer than the basal, and there are four cross-veins before the radial sector in hind-wing.

MARACANDULA BELLULA Banks.

Trans. Amer. ent. soc., 1906, **32**, p. 7.

Face pale, a brown interantennal mark, emarginate below antennae, and extending above a short distance (sometimes faint); vertex with two rounded dark spots; palpi pale; antennae brown, a pale band of about three joints beyond middle; pronotum pale, and oblique brown spot on each outer side in front, sometimes traces of median spots, and a large brown spot behind in middle (sometimes all spots are faint), hair almost wholly white; rest of notum pale to brown, more or less obscurely spotted with brown, hair white, except some dark on the anterior lobes; pleura more or less brown, with several pale spots, hair white; legs pale, the femora streaked or dark at tip, tibiae dark at tip and often near base, middle tarsal joints dark. Abdomen dull black, segments with pale spots on base above, basal segments largely pale, hair below white, above white on pale areas, rest dark. Wings with small brown spots, base of stigma black, several brown spots between the subcosta and radius and extended back on cross-veins, several along upper edge of cubitus, at rhégma, and at end of anal vein, marginal forks scarcely clouded, and sometimes faintly along hind-margin at ends of veins. Hind-wings scarcely spotted, but a cloud at rhégma, and one at stigma; venation in both wings brown and white alternating.

Pronotum little longer than broad; vertex much elevated, bilobed; legs slender, basal tarsal joint elongate. Wings broad, especially toward tip; four to six cross-veins before radial sector in fore-wing, one to three in hind-wing, some often connected; cubitals not crossed; radial sector with five branches; hind-margin of both wings concave at base; in fore-wing about seven to ten short subequal branches to the first anal vein, in hind-wing about four such branches; venation with many rather long curved hairs.

Length fore-wing 15 to 20 mm., width 4.8 to 6.2 mm.

Length hind-wing 13 to 18 mm., width 3.1 to 4.2 mm.

Length abdomen ♀ 10 to 14 mm., ♂ 13 mm.

Specimens examined.—Calif.: Three Rivers, San Jacinto Mts. Utah: Coal Creek, Iron Co.; Eureka, August; St. George, June. Ariz.: Reef, June; Palmerlee, June, July. Also Santa Rita Mts., Arizona (Snow coll.). Phoenix, Arizona (Adams coll.).

MACRONEMURINAE.

This subfamily is represented by four very distinct genera grouped in two tribes. In the tropics there are several other tribes and a great number of species. The Nearctic genera are tabulated as follows:—

1. Legs very slender, femora cylindric, front-femur about twice as long as front-coxae and longer than height of thorax; pronotum usually longer than broad (*Glenurini*) 2
 Legs not especially slender, femora somewhat thickened, front-femur less than twice as long as front-coxae, nor longer than height of the thorax; pronotum usually broader than long. (*Macronemurini*) 3
2. Hind-wings with large dark spot near tip; broadest at or beyond rhagma. *Glenurus*.
 Hind-wings without large spot, broadest rather before the rhagma. *Eremoleon*.
3. Fore-wing with two series of costal cells for part way; venation dense and irregular *Puren*.
 Fore-wing with but one series of costal cells; venation open and regular. *Psammoleon*.

PSAMMOLEON Banks.

Can. ent., 1899, **31**, p. 69.

Labial palpi with last joint swollen; antennae moderately long, not much separated at base; pronotum rarely longer than broad; abdomen short in both sexes, and much shorter than the wings. Legs moderately stout, hind-tibia shorter than or equal to hind-femur, basal joint of tarsus short or elongate, spurs equal to two or three joints in front-legs, and to one and one half to two and one half joints in the hind-legs. Wings moderately broad to narrow, the costal area simple, radial sector much beyond the cubital fork in fore-wings, in hind-wing radial sector near base, one cross-vein before it. In fore-wing the second anal is united to third for a long distance; no distinct Banksian line; in hind-wing the second anal is forked, and the third anal is connected at tip to a short vein close to the hind-margin, and almost united to it. The fore-wings show more or less distinctly a dark line or spot at end of anal, and a similar mark up from rhagma.

TYPE.—*P. ingenuus* (Walker). South America.

Five species are known from southern parts of the Nearctic region and may be separated as follows:—

1. Tarsi black, hind-femora, as well as others, mostly black; basal tarsal joint elongate, spurs also elongate, but little curved, hind-spurs not equal to two tarsal joints, last ventral segment of male with black hair. 2

- Tarsi mostly pale on basal and apical joints, hind- and mid-femora at least mostly pale, and dotted with dark, spurs curved, hind-spurs equal to or longer than two joints, basal tarsal joint less elongate, last ventral segment of male with white hair as rest of venter. 3
2. Abdomen wholly black, not spotted; pronotum about as long in middle as broad, male appendages with a projection at lower corner, hind-tibia equal hind-femur. *connexus*.
Abdomen with two elongate pale spots on each segment above; pronotum much broader than long in middle, male appendages without projection at lower tip. *bistictus*.
3. Abdomen with two elongate spots on each segment above; hind-spurs equal to two joints; cubital area of hind-wing narrow, with but one series of cross-veins, superior appendages of male extended below, but no projection behind. *minor*
Abdomen with two rounded spots on some of the segments, scarcely marked toward tip; hind-spurs equal to two and one half joints; cubital area of hind-wings broad, with two or three series of cross-veins, male superior appendages with a distinct projection behind at lower tip. 4
4. Fore-wings with two dark nearly parallel streaks. *guttipes*.
Fore-wings with the two streaks connected to make a sinuous line. *sinuatus*.

PSAMMOLEON BISTICTUS (Hagen).

Plate 2, fig. 33.

Myrmeleon bistictus Hagen, Synop., 1861, p. 235.

Interantennal mark extending considerably below antennae, above the surface is sericeous and on the vertex also, the vertex scars are black; last joint of labial palpi mostly black; antennae scarcely annulate; pronotum dull black, sericeous, with pale median line, and broader pale streak on each side; rest of notum dull black, with a number of pale spots, mostly through the middle area; pleura dark, with a few pale spots, hair white; legs largely black, front-femur pale in front, mid- and hind-femora with pale band or spot beyond middle, tibiae pale at base, and a pale spot or streak on outer side, tarsi almost wholly black, femora and tibiae with white hair and many black bristles. Abdomen dull black, sericeous, each dorsal segment with a long pale streak each side, sometimes divided into two spots; hair white, but in male that of last ventral is black. Wings not heavily marked, the usual two oblique lines from anal and from rhexma, latter pointing to apex of wing; a dark spot at base of stigma, some marginal forks clouded, otherwise not marked, venation dark and pale in streaks;

hind-wings unmarked, except at stigma, the median and first anal vein wholly pale.

Pronotum plainly broader than long in middle; basal joint of tarsi elongate, spurs elongate, scarcely curved, the hind-spurs about equal one and one half joints, front-spurs equal to two joints. Fore-wings with costals simple, seven cross-veins before radial sector, ten branches to this sector; in hind-wings the cubital area is fairly broad with two or three series of cross-veins. The superior male appendages are not produced behind at lower corners.

Length fore-wing 29 mm., width 7 mm.

Length hind-wing 27 mm., width 5.7 mm.

Length abdomen 17 mm.

Specimens examined.—Fla.: Dry Tortugas, June.

Described from Cuba, where it is not uncommon.

PSAMMOLEON MINOR, sp. nov.

Plate 2, fig. 32, 42.

Interantennal mark extending straight across below antennae, above is a pale area before the vertex rows, which are black; palpi pale; antennae plainly annulate, base pale; pronotum dull black, a median pale line, and lateral spots fairly distinct; rest of notum dull black, with several pale spots, a pair on the mesoscutellum, and the middle tips of both scutelli also pale; pleura with much pale, hair white; legs pale, femora and tibiae rather sparsely dotted, both dark at tips, tips of tarsal joints dark, femora with many black and some white bristles and appressed white hair. Abdomen dull black, much marked with pale, venter mostly pale, above each segment has the tip and an elongate spot each side pale, some apical segments with a median spot, hair white above and below in both sexes, bristles around genitalia black. Wings with the venation interruptedly pale and dark in streaks, dark spot at base of stigma, near end of anal, and a short streak up from rhagma, a few apical veinlets margined; hind-wings scarcely marked, faint dot at stigma, rhagma, and one apical cross-vein.

Pronotum a little broader than long in middle; tarsi with basal joint somewhat elongate, more so than in *guttipes* the spurs also elongate and not much curved, the hind-spurs just about equal to two joints. Wings slender, scarcely any costals before stigma forked, six cross-veins before radial sector, latter with nine or ten branches; in hind-wings the cubital area is very narrow, and has but one series of

cross-veins. Superior appendages of the male have no projection behind, but are rather lobed below.

Length fore-wing 22 mm., width 5 mm.

Length hind-wing 21.5 mm., width 4 mm.

Length abdomen 12 mm.

TYPE.—M. C. Z. 15,746. ♂, ♀. Fla.: Dry Tortugas, Loggerhead Key, June (J. McClendon, and H. L. Clark).

PSAMMOLEON GUTTIPIES Banks.

Plate 2, fig. 38, 43.

Psammoleon guttipies Banks, Psyche, 1906, 13, p. 99.

A black band below antennae, above brown up to and on vertex, usually leaving the vertex scars showing pale, but sometimes they are covered by dark velvety brown; palpi mostly pale; antennae narrowly annulate, base pale; pronotum dull brown, a faint pale median line and sometimes one or two spots on each side; rest of notum dull brown, slightly sericeous, a few pale spots, often a pair in front of the metascutellum; pleura dark, with a few pale spots, hair long, white; legs pale, femur and tibia much dotted, front femur sometimes dark above, tibia dark at tip, basal and apical tarsal joints mostly pale, femora and tibiae with many black bristles and hairs, and some more appressed white hair, less noticeable; abdomen dull black, a pale spot above on each side near middle of several segments shows more or less distinctly, sometimes united, hair short, mostly white. Wings but little marked, but there are two subparallel streaks or lines in front-wings, one up from the end of anal, the other from the rhagma, the latter so directed that it would end on costa long before apex of wing, usually some apical cross-veins and forkings are marked, and several radial cross-veins margined; venation dark and pale in streaks; hind-wings scarcely marked, a few cross-veins margined, a dot at rhagma, and outer marginal forks marked. Pronotum much broader than long; legs rather stout, hind-tibia not quite as long as hind-femora, basal tarsal joint short, hardly equal to next two together; spurs stout, strongly curved, in front-legs fully equal to three joints, in hind-legs about two and one half joints. The costal area of fore-wings is fairly broad, about seven cross-veins before radial sector, latter with about eleven or twelve branches; in hind-wings the cubital area is quite broad with two or three series of cross-veins. The superior appendages of the male have a projection at the lower tips.

Length fore-wings 29 to 31 mm., width 6 to 7.5 mm.

Length hind-wings 28 to 30.5 mm., width 5 to 6 mm.

Length of abdomen 19 mm.

Specimens examined.— N. C.: Tryon (Type); Southern Pines, June. Ga.: Millen. Florida. La.: Shreveport. Tex.: Travis Co.; San Antonio; Dallas, August. Also Lakehurst, New Jersey (Davis coll.), Brownsville, Texas (Brooklyn mus.), Spring Creek, Georgia (Cornell univ.).

PSAMMOLEON SINUATUS Currie.

Plate 2, fig. 34.

Psammoleon sinuatus Currie, Proc. Ent. soc. Wash., 1903, 5, p. 275.

This in general agrees with *P. guttipes* and was described as a variety of that species. It is a western form of that species. The interantennal mark usually does not extend under the antennae, the vertex scars are marked deep black, the lateral marks of pronotum are usually more distinct, the legs and the abdomen are marked the same. The fore-wings have the two oblique lines, normally connected so that it makes a sinuous or serpentine mark, the outer part of this mark points toward the apex of the wing (thus differing from *guttipes*). In the hind-wing the rhagma is usually well marked, and the veins behind it to the margin are bordered with dark. The rest of the wings is not as much spotted as in *guttipes*. Structurally it is about the same as *guttipes*, but the superior appendages of the male have not such a long, but more acute projection at the lower tip.

Length fore-wing 29 to 35 mm., width 6.5 to 9 mm.

Length hind-wing 28 to 34 mm., width 5 to 7 mm.

Length abdomen 20 mm.

Specimens examined.— N. M.: Jemez Mts., August. Ariz.: Palmerlee, July. Utah: Coal Creek, Iron Co., June.

Currie described it from the Santa Rita Mts., Arizona, and recorded it from Bear Creek Canyon, Colorado.

PSAMMOLEON CONNEXUS (Banks).

Plate 2, fig. 35, 44.

Puren connexus Banks, Bull. M. C. Z., 1920, 64, p. 329.

Interantennal mark deep black, extending somewhat below antennae, above dull black to sericeous on vertex, the vertex scars deep black; last joint of labial palpi mostly black; antennae very narrowly

annulate; pronotum dark, a median pale line, and a streak or two pale spots on each side; rest of notum dark, a few pale spots and streaks, usually two on the mesoscutellum; pleura largely dark, hair white; legs mostly dark, femora pale within or beneath, and some pale on tibiae behind, tarsi almost wholly black, femora and tibiae heavily clothed with long white hair, very noticeable, some black bristles below. Abdomen dull black, not spotted, hair very short, white but the last two ventral segments have dense black hair. Wings with venation mostly dark, pale in spots and patches; a dark spot at base of stigma, a short streak at end of anal, a longer one up from rhexma (in the TYPE these are connected in a sinuous line), the outer line points toward the apex of the wing, apical forks often marked, the radial cross-veins not margined, but often some veins behind the radial sector are margined to make a streak, and the cubitus is sometimes margined from rhexma toward base; hind-wings less marked, but sometimes the cubitus is margined toward the rhexma. Pronotum rather longer than in the other species, nearly as long in middle as broad; legs with basal tarsal joint elongate, and so are the spurs, so that they are little curved except near tip, and the hind-spurs are only equal to one and one half joints. In the fore-wings there are usually a few costals before the stigma forked; six or seven cross-veins before radial sector, the latter with about nine or ten branches; in the hind-wings the cubital area usually has two series of cross-veins, at least for part way. The superior appendages of the male have a rather short, sharp projection at the lower tips, not as long as in *guttipes*.

The TYPE specimen has a remarkable venational peculiarity; instead of the short oblique cross-vein representing the median fork, there is a very long branch, occupying the space of about three cells and ending just before the fork of cubitus.

Length fore-wing 25 to 30.5 mm., width 5.7 to 7 mm.

Length hind-wing 24.5 to 29.5 mm., width 4.5 to 5.5 mm.

Length abdomen 19 mm.

Specimens examined.—Calif.: San Jacinto Mts., June (TYPE). Ariz.: Palmerlee, July. Tex.: Austin.

PUREN Navas.

Revis. Chil., 1911, 15, p. 125.

Last joint of labial palpi swollen; antennae rather long, but little separated at base, pronotum scarcely broader than long; the abdomen much shorter than the wings; legs rather short, femora somewhat

thickened, spurs elongate, but little curved, equal to two joints in front-tarsi, and little more than one in hind-tarsi, hind-tibia rather shorter than hind-femur. Wings of moderate width, in fore-wing the second anal is united to third for a long distance, basal cubital fork distinct, costal area broad, partly two-celled, radial sector much beyond the cubital fork, in fore-wing the Banksian line is fairly distinct; in hind-wings the first anal runs parallel to cubital fork for a very short distance.

TYPE.—*P. bellator* Navas. Chile.

I have not seen the genotype, the species I have placed here differs from *Psammoleon* only in partly double costal area, and denser venation; in tarsal and spur characters it agrees closely with *Psammoleon connexus* and *P. bistictus*.

PUREN INSCRIPTUS (Hagen).

Plate 4, fig. 80, 93.

Myrmeleon inscriptus Hagen, Synop., 1861, p. 230.

Interantennal mark extending a little under the antennae, above less black up to the vertex which is sericeous, the vertex scars black; last joint of labial palpi black; antennae narrowly annulate; pronotum dull black, with a pale median line, and each side with a pale rounded spot in the front-part and a longer streak in the hind-part; rest of notum dull black, sericeous, with some pale spots mostly in middle area; pleura partly dark, with much pale below, hair white; legs mostly black, front-femur pale at base and within, hind-tibia pale at base behind, hair largely white, but some black especially on tibiae; abdomen dull black, the apical margin of segments above pale, hair short, white. Fore-wings heavily marked, two oblique lines, one up from end of anal, the other from rhexgma, and pointing toward apex of wing, sometimes the two lines faintly connected; a large spot at base of stigma, and extended behind over last radial cross-vein; longitudinal veins mostly black, but marked with pale in streaks, cross-veins almost wholly black, and nearly all are slightly margined. There are about four patches of white veins, just behind the radius and over the radial sector. Hind-wings much less marked, a spot at stigma, venation mostly dark, but few veins margined except the outer forks, median vein wholly pale.

Pronotum about as long in middle as broad; tarsi with basal joint elongated, equal to next two joints or more; spurs elongate, scarcely

curved, front ones equal to two joints, hind spurs scarcely longer than basal joint. Costal area of fore-wings fairly broad, many of the costal veins forked, and about one third to one half of them crossed, mostly near the middle of length; seven cross-veins before radial sector, one or two crossed, about twelve branches of radial sector, several costals crossed; cubital area of hind-wings fairly broad, two or three series of cross-veins; all venation dense and irregular. The male superior appendages have a projection at lower tip.

Length of fore-wing 28 to 31 mm., width 6 to 7.5 mm.

Length of hind-wing 26 to 29 mm., width 5 to 6 mm.

Length of abdomen 20 mm.

Specimens examined.—N. M.: Pecos River (TYPE); Las Vegas. Utah: St. George, May.

GLENURUS Hagen.

Stett. ent. zeit., 1866, **27**, p. 372.

Last joint of labial palpi swollen; antennae long and slender, less than diameter of basal joint apart; pronotum longer than broad; legs very slender, basal tarsal joint elongate, sometimes equal to the fifth; spurs elongate, little curved, equal to two joints; abdomen much shorter than wings. Wings very broad toward tip, and the hind-pair at least with large spots, costal area simple, radial sector in fore-wings beyond the cubital fork, but before end of anal vein, first branch of radial sector beyond end of anal, basal cubital fork distinct, no Banksian nor intercubital line; in hind-wing the second anal forked, the first anal bends down to margin near cubital fork, no short vein parallel to hind-margin at base and connected to third anal.

TYPE.—*G. gratus* (Say).

In a South American species (*incalis*) there is the beginning of a Banksian line close to the median and curving upwards, as in the African genus, *Cymothales*.

The two Nearctic species belong to two different sections of the genus and may be separated as follows:—

1. Extreme tips of wings dark; fore-wing with large clear space near apex rosy; hind-wings with the large dark spot leaving two clear spaces; legs dark; first anal in hind-wings ends beyond the cubital fork. *gratus*.
 Extreme tip of wings pale; fore-wings with the space beyond large spot broken by many small spots; hind-wings with the large dark spot leaving three clear spaces; legs mostly pale; first anal in hind-wings ends before cubital fork. *snowi*.

GLENURUS GRATUS (Say).

Plate 2, fig. 45.

?*Formicaleo grata* Say, Journ. Acad. nat. sci. Phil., 1839, 8, p. 45. Ed. Lec., 2, p. 413.

Face black, the lip and a band below antennae pale; vertex dark, a pale line in front and one behind; palpi and antennae dark; pronotum black, a pale median line which is widened in front, near middle, and behind; rest of notum black, with pale median line more or less complete, mesoscutellum with two pale spots; pleura black with scattered white hair; legs reddish brown, hind-tibia behind and the tarsi pale, hair and bristles black, front-tibia at tip beneath with yellowish hair. Abdomen black, tips of the segments sometimes narrowly pale above, hair fine short and black. Wings with a large compound dark spot just before tip in both pairs, this spot is made up of three large spots, closely united in hind-wings, less so in front-pair. In fore-wings beyond the spot the wing is whitish with a rosy tint, the extreme apex dark, and dark clouds along outer hind-margin; at end of anal a rather large spot, a number of smaller spots along cubitus, and dark streaks between subcosta and radius, venation mostly dark, but many longitudinal veins are white in spots. In hind-wing beyond the large trilobed spot the wing is also pale, with less distinct rosy tint, the extreme tip also black, the large spot reaches the hind-margin in two places, and in the pale apical part there is a small dark spot, almost connected to the large trilobed spot, venation almost wholly dark. Basal tarsal joint about as long as apical, spurs equal two joints; wings broad toward tips which are almost rounded; fore-wings with about ten cross-veins before radial sector, about eleven branches to radial sector, sometimes a few cubitals are crossed. In hind-wings the cubital area is broad, with four to five series of cross-veins, the first anal running parallel to cubital fork for a short distance, and usually connected once or twice to it.

Length fore-wing 34 to 47 mm., width 9 to 15 mm.

Length hind-wing 33 to 45 mm., width 8.4 to 13 mm.

Length abdomen ♀ and ♂ 24 to 25 mm.

Specimens examined.—Ohio: Cincinnati. Ky.: Bee Spring, Cumberland Gap. Tenn.: Redboiling Springs. Fla.: Lake Worth.

GLENURUS SNOWI Banks.

Ent. news, 1907, 18, p. 100.

Face black, pale on side under each eye, vertex pale, the vertex scars black; palpi and antennae dark brown; pronotum black, with pale median line; rest of notum also black, and with an incomplete pale median line, hind-edge of the mesoscutellum pale; pleura black, hair white; legs pale, femora darkened above and near tip, tibiae dark near base and at tip, tarsal joints less distinctly dark at tip, hairs and bristles mostly black, but front-tibiae at tip beneath with yellowish hair. Abdomen dull black, some segments narrowly pale above at tips, hair on venter white, but that on last segment dark, above with white hair near base. Fore-wings with a large dark spot near tip broken up into many small, mostly confluent, rounded spots, the space beyond pale, but with some small spots, a large spot at end of anal, two or three along margin beyond it, and several before it, a number between median and cubitus, the space between subcosta and radius dark and extending behind in several places, elsewhere (mostly in apical part) are numerous small dots at connection of veins; venation largely dark, but white in places. Hind-wing with a very large, rather four-lobed dark spot near tip, leaving a space on costal margin, the tip, and a space on hind margin pale; dark streaks between subcosta and radius; venation partly dark and pale. Legs hardly as long as in *G. gratus*, the basal tarsal joint not as long as apical, the spurs equal two joints. The wings are less broad toward tip than in *G. gratus*, the apex almost acute; seven cross-veins before radial sector in fore-wing, ten branches to radial sector; in hind-wings the cubital area is broad, with three or four series of cross-veins; the first anal bends down before cubital fork.

Length fore-wing 35 mm., width 10 mm.

Length hind-wing 33.5 mm., width 8.6 mm.

Length abdomen 19 mm.

Specimen examined.—Ariz.: Baboquivari Mts. (TYPE).

There is a second specimen in the Snow collection.

EREMOLEON Banks.

Trans. Amer. ent. soc., 1901, 27, p. 365.

Last joint of labial palpi but little swollen; antennae rather long and slender, not the diameter of basal joint apart; pronotum longer than broad; legs very long and slender, hind-tibia longer than hind-femur,

basal tarsal joint shorter or hardly equal to apical; spurs about equal to two joints or more; abdomen shorter than wings. Wings moderately broad, broadest before rhexma; costal area simple; radial sector plainly beyond the cubital fork, about opposite end of anal vein; second anal united to the third for a short distance, sometimes both forked; no Banksian line. In hind-wing but one cross-vein before radial sector, second anal forked, third connected at tip to a short vein parallel to margin of wing, first anal bends down at cubital fork.

TYPE.—*E. macer* (Hagen).

Differs from *Glenurus* greatly in appearance, but structurally very similar, the wings are broader toward middle, while in *Glenurus* they are broader toward tip; the venation, especially toward apex, is much less dense than in *Glenurus*, but the absence of large spots readily separates it.

The two Nearctic species are separated in the following table: —

1. Fore-wings at base with a prominent black spot, no distinct spot at end of anal, cross-veins almost entirely dark, femora plainly dotted. *nigribasis*.
Fore-wings without prominent black spot at base, a distinct mark at end of anal, many cross-veins entirely pale, femora scarcely if at all dotted.

macer.

EREMOLEON MACER Hagen.

Plate 2, fig. 31, 39.

Myrmecleon macer Hagen, Synop., 1861, p. 236.

Face pale, interantennal mark black, extending below but scarcely above antennae; vertex gray, vertex scars of first row brown or black, others scarcely marked; palpi and antennae pale, tip of latter brown; pronotum pale, scarcely marked with dark, sometimes a paler median stripe, a dark dot each side on the furrow; rest of notum pale, traces of dark spots, and a paler median line; pleura pale; legs pale, femora unmarked except dark at tips, tibiae dark at tips and spotted on outer side, tarsi pale, tip of last joint dark, bristles and hairs black, or yellowish. Abdomen dull brown, segments with large pale spot above, larger on basal segments, venter mostly pale, hairs white. Wings but little marked, a brown spot at base of stigma, one at rhexma, and one at end of anal, several radial cross-veins faintly margined with brown, also some faint clouds along the cubitus, and a few elsewhere, none very definite; venation mostly pale, but with brown streaks; hind-wings unmarked, but the pale venation is broken with dark. In fore-wing nine or ten cross-veins before radial sector, none connected,

about six branches of radial sector, no cubitals crossed; hind-wings with cubital area fairly broad with about three series of cross-veins.

Spurs slender, scarcely curved except at tip, front spurs equal about two and one half joints, hind-spurs equal about two joints; in front-tarsus the basal joint is about two thirds of the last, in hind-tarsus the basal joint about equal to last.

Length fore-wing 28 mm., width 8.5 mm.

Length hind-wing 27 mm., width 7 mm.

Length abdomen 18 mm.

Specimens examined.— Ariz.: Garcia; Palmerlee. Also Mexico (TYPE).

It has been redescribed by Navas as *Segura vitreus*, Mexico.

EREMOLEON NIGRIBASIS Banks.

Plate 2, fig. 26.

Eremoleon nigrbasis Banks, Bull. M. C. Z., 1920, 64, p. 329.

Face below yellowish, above more gray and also on vertex, almost no trace of interantennal mark, a few irregular spots on vertex; palpi and antennae pale, latter dark at tip. Pronotum reddish gray, traces of marks each side near middle, and a dark streak on each side; rest of notum reddish gray, with many small dark spots or streaks; pleura pale, with two broken dark stripes; legs pale, femora and tibiae dotted with brown, latter dark at tips, bristles black; abdomen reddish gray, each segment with a large black spot above, usually near tip, hair short, white.

Wings with no large marks, brown spot at base of stigma, at rhegma, and a prominent black spot at base; longitudinal veins pale, marked with brown, cross-veins almost wholly dark, in many cases very narrowly margined; hind-wings unmarked except faint spot at rhegma, veins pale, with few dark spots. In fore-wings six cross-veins before radial sector, none crossed, about eight branches of radial sector, no cubitals crossed; in hind-wings cubital area fairly broad, with two or three series of cross-veins. Spurs more curved than in *macr*, front-spurs equal nearly two and one half joints, hind-spurs almost equal two joints; basal joint of front-tarsus but little more than one half of the apical, basal joint of hind-tarsus about two thirds of apical.

Length fore-wing 24 to 27 mm., width 6.3 to 7.5 mm.

Length hind-wing 22 to 25 mm., width 5 to 6 mm.

Length abdomen 14 to 15 mm.

Specimens examined.— Utah: St. George, June (TYPES).

MYRMELEONINAE.

This, the most specialized subfamily, is readily separable into two tribes, each of which is found in all the regions of the world.

1. Claws much curved or bent; thorax above and on pleura, as well as the legs with very long, mostly white hair, hair on legs much longer than the black bristles; the sense-hair at base beneath of femur as long as femur; body rather stout; basal tarsal joint as broad as long. . . . *Acanthaclisini*.
Claws scarcely curved, rarely longer than the basal joint; hair on thorax and legs short, that on legs much shorter than the black bristles; the sense-hair at base of femur beneath (when present) never as long as the femur; body rather slender; basal tarsal joint much longer than broad.

Myrmeleonini.

MYRMELEONINI.

Of this the typical group only, the typical genus, *Myrmeleon*, occurs in the Nearctic fauna.

MYRMELEON Linné.

Syst. nat., 1767, ed. 12, 1, pt. 2, p. 913.

Second anal vein of fore-wing as given for subfamily; in hind-wing at least four or five cross-veins before radial sector; antennae widely separated at base; radial sector in both pairs beyond cubital fork, but sometimes not so much so in fore-wings; a single series of costal cells; Banksian line indistinct or absent; intercubital line usually distinct; apical field with some cross-veins; in fore-wing the cubitus shows at base a branch which runs parallel to the first anal for a short distance, and is connected to cubitus by one cross-vein. In hind-wing the third anal at base runs close to the second and typically (*formicarius* and *immaculatus*) is forked, but in most Nearctic species it is simple. Legs short; fifth tarsal joint plainly longer than first; the spurs about equal to the first joint.

The abdomen of male is not longer than in female; in both sexes the last segment is very short, and in the male the next to last segment is shorter than in the female.

TYPE.—*M. formicarius* Linné. Europe.

There are six good and one doubtful Nearctic species.

1. Cross-veins between radius and radial sector reduced in number so that some of these cells are very much longer than the normal cells behind them; first anal vein ends nearly as far out as origin of radial sector,

- three connections between this anal and the cubital fork; second anal usually connected to first branch of first anal; third anal vein of hind-wings forked; large species. *immaculatus*.
 Cross-veins between radius and radial sector normal, the cells about same size as other cells near by; third anal of hind-wings simple. 2
2. Wings with veins unmarked; a yellow stripe through bases of wings; pronotum with a broad median dark stripe, sides broadly pale; legs reddish, mostly unmarked; upper half of clypeus black. *texanus*.
 Wings more or less dotted or spotted on the veins; pronotum more dark than pale. 3
3. Radial sector almost as far basad as the cubital fork; three or four connections between anal and cubital fork; no black on the clypeus; lateral margin of pronotum at least partly dark; tarsi partly pale; a pale spot on each lateral lobe of the metanotum. *mobilis*.
 Radial sector much beyond cubital fork; usually black marks on the clypeus. 4
4. A fairly broad stripe of clear yellow along outer margin of pronotum back through bases of the wings, so that the upper edges of pleura are yellow; tarsi almost wholly black; three or four connections from anal to cubital fork. *heriocles*.
 No such yellow stripe; the posterior corners of pronotum dark or at least dark in front of base of fore-wings; usually but two cross-veins between anal and cubital fork. 5
5. No dark on clypeus; posterior part of mesonotum pale. *diversus*.
 Clypeus with dark; mesonotum all dark. 6
6. Vertex all dark; tarsi mostly dark; usually two rows of gradates in the apical area; last joint of labial palpi not greatly swollen, and with rather long point. *crudelis*.
 Vertex spotted with pale; tarsi marked with pale; usually but one row of gradates in the apical area; last joint of labial palpi greatly swollen and with short point. *rusticus*.

A natural grouping of the Nearctic species would be as follows: —

- a. Pronotum about twice as broad as long; usually three or four connections between first anal vein and cubital fork, large species.
 b. Some hair on pronotum black. *immaculatus* and *mobilis*.
 bb. All hair on pronotum white; more than four cross-veins before radial sector in hind-wing. *heriocles*.
- aa. Pronotum but little broader than long in the middle; smaller species; usually but two connections between first anal vein and cubital fork.
 c. Vertex wholly dark. *crudelis* and *texanus*.
 cc. Vertex maculate. *rusticus* and *diversus*.

MYRMELEON IMMACULATUS DeGeer.

Plate 2, fig. 36.

Myrmeleon immaculatus DeGeer, Mem., 1773, 3, p. 364, pl. 27, fig. 8.

Face shining dark brown or blackish, sides near eyes and the clypeus pale yellowish, above the antennae dull blackish; vertex dark, with the transverse spots shining; pronotum dull black, the lateral anterior corners pale, two pale spots in front-part, and behind two farther apart and more indistinct; rest of the notum black, the margins narrowly pale; the pleura black; legs pale, femora and tibiae more or less dotted, and dark at tips, the tibiae also dark near base, and on under side, tarsi mostly dark, but pale on bases of first and fifth joints, bristles black. Abdomen dark, sometimes pale spots at bases of segments above, hair mostly white, but in the female the last segment and tips of others above with short black hair.

Wings unmarked, stigma pale, venation with many dark spots and streaks.

Last joint of labial palpi moderately enlarged; a shallow, rounded impression in middle of face below antennae; pronotum twice as broad as long. In the fore-wing the cross-veins between radius and radial sector are reduced in number so that some of these cells are elongated; in middle of wing is a faint beginning of the Banksian line; the intercubital line (in middle part) as near (or almost so) to hind margin as to the cubitus; the radial sector much beyond cubital fork, about opposite the end of the first anal vein, about eight cross-veins before it; the second anal is connected to the first branch of the first anal vein; three or four connections between first anal and cubital fork; scattered cross-veins in apical field. In hind-wing the intercubital much nearer cubitus than to margin; the anal tends to run into the cubital fork; the third anal vein is forked.

In the variety *occidentalis*, there are dark marks between subcosta and radius, and these may be extended back over some of the radial cross-veins. However not all western specimens are thus marked, and sometimes eastern specimens are marked.

Length fore-wing 22 to 36 mm., width 5.8 to 8 mm.

Length hind-wing 20 to 34 mm., width 5 to 6.8 mm.

Length abdomen 18 to 22 mm.

Occurs practically all over the United States reaching into Canada in various places; more common in Southwest than elsewhere. Specimens examined are from the following states:—N. H., N. Y., Md.,

Mich., Va., N. C., Colo., N. M., Ariz., Utah, Nev., Wash., Ore. and Calif. Also from B. Col., and have seen specimens from Pa., Wyo., N. J., Okla., Ohio, and Fla.

Recorded by Currie from Illinois and Louisiana.

MYRMELEON MOBILIS Hagen.

Can. ent., 1888, 20, p. 204.

Marks of face and vertex very much as in *immaculatus*, the clypeus unmarked, pronotum with more pale, the pale spots larger and more or less connected, metanotum with two pale spots above, pleura somewhat spotted with pale, legs less dotted than in *immaculatus*, femora with apical marks, tibia with subbasal and apical spots, and the tarsi more pale, bristles black. Abdomen brown, with white hair, under-side of last segments of female with short black hair, at least in apical part. Wings unmarked, stigma pale, veins marked as in *immaculatus*; the cells between radius and radial sector numerous and fairly short; intercubital line distinct, much nearer to cubitus than to margin. Radial sector farther basad than in *immaculatus*, only a little beyond the cubital fork, about seven cross-veins before it; second anal usually connected to first branch of the first anal; three or four connections between first anal and the cubital fork; about eleven branches to radial sector; scattered cross-veins in apical field. In hind-wing the intercubital line is distinct, with only one row of cells between it and the cubitus; third anal vein not forked. Face, pronotum, and legs as in *immaculatus*. The measurements are similar to those of *M. immaculatus*.

The type is from Savannah, Ga. (Winthem coll.).

Hagen received several specimens from Alabama, and I have one from Bainbridge, Ga., September.

Though generally confused with *immaculatus*, the numerous cross-veins between radius and radial sector, and the simple third anal vein in hind-wings, as well as color-marks, will separate it.

MYRMELEON HERIOCLES Banks.

Proc. Acad. nat. sci. Phil., 1914, p. 619.

Face rich dark brown; clypeus pale, with two dark spots, last joint of labial palpi black, above antennae and the vertex dark brown, but vertex usually a little paler than face; basal joints of antennae more or less pale, rest black; pronotum dark, lateral margins pale, three spots

in front, the lateral ones connected to pale margin, and two less distinct behind; rest of notum and the pleura dark, the yellow of the sides of pronotum is continued back through the bases of the wing, so that the upper edge of pleura is yellow and also the connecting parts at base of the wings; hair on thorax white. Femora more or less infusate in the middle, pale at ends, under-side and tips of tibiae dark, and tarsi almost wholly black, bristles black. Abdomen dull blackish, with white hair, in the female the last two segments with short black hair. Wings unmarked, stigma pale; venation dotted with dark, with longer spots on main veins. No broad impression on face; pronotum about twice as broad as long. Wings with radial sector much beyond the cubital fork, about ten cross-veins before it, in hind-wings from five to eight veins before radial sector; the intercubital line distinct, much nearer to cubitus than margin; three or four connections between the first anal and the cubital fork; second anal often connected to the first branch of the first anal; about eleven branches of the radial sector, scattered cross-veins in apical field; in hind-wing the third anal is not forked.

Length fore-wing 31 to 36 mm., width 7.3 to 8.6 mm.

Length hind-wing 29 to 34 mm., width 6 to 7 mm.

Length abdomen 22 to 23 mm.

Specimens examined.—N. C.: Southern Pines, May (TYPE). Fla.: Crescent City. N. J.: Lakhurst (Brooklyn mus.).

MYRMELEON TEXANUS Banks.

Plate 4, fig. 81.

Myrmeleon texanum Banks, Ent. news, 1900, **11**, p. 596.

Face reddish brown, extending down on upper part of clypeus, rest of clypeus and sides of face near eyes pale yellow, above antennae dull reddish, vertex more shining reddish; last joint of labial palpi pale. Pronotum pale yellow, with a median brown stripe, about twice as broad behind as in front; rest of notum and the pleura a dull reddish brown; base of wings yellowish; all hair on thorax white. Legs reddish; the tibiae more yellow on upper sides; bristles black; abdomen dull brown, with white hair, in the female the last segments with short black hair.

Venation of wings pale yellowish, unmarked. Last joint of labial palpi but little swollen; pronotum but little broader than long in the middle. In both wings the radial sector is beyond the end of anal, in

fore-wings about ten, and in hind-wings four cross-veins before radial sector; about twelve branches to radial sector; intercubital line distinct, two or three cells from the cubitus; in hind-wing the intercubital line less distinct, irregular; in fore-wing two or three connections from first anal to cubital fork; second anal not connected to first branch of first anal; scattered cross-veins in apical field; in hind-wings the third anal not forked. In all of the few specimens seen the fork of the median in the fore-wings ends before the cubital fork (rarely so in any other species).

Length fore-wing 27 mm., width 7 mm.

Length hind-wing 25 mm., width 5.3 mm.

Length abdomen 20 mm.

Specimens examined.—Tex.: Galveston, June (TYPE); Austin.

MYRMELEON CRUDELIS Walker.

Plate 2, fig. 37.

Myrmeleon crudelis Walker, Cat. Neur. Brit. mus., 1853, pt. 2, p. 388.

Face shining brown or blackish; clypeus with two dark spots; vertex more or less reddish brown. Pronotum narrowly pale on the sides, and more or less in front and each side near middle, but quite variable, always dark in middle and a dark stripe each side to the furrow, but these not sharply defined and sometimes confluent into one large dark middle area; clothed with white hair; rest of notum dark, scutelli narrowly bordered behind with pale; pleura dark, with two or three small pale spots. Femora broadly dark toward tip, tibiae near base, beneath, and at tip, tarsi almost wholly dark, bristles black. Abdomen dull brown, tips of several segments above pale, hair white, in female last ventral with black hair. Venation pale, mostly dotted, but some of the principal veins with larger spots or streaks. Last joint of labial palpi moderately swollen; pronotum as long in middle as broad. In fore-wings about seven cross-veins before radial sector, four in hind-wings; ten to eleven branches of the radial sector; in fore-wings first anal is connected to cubital fork two (sometimes three) times; second anal rarely connected to first branch of first anal; scattered cross-veins in apical field, intercubital line much nearer to cubitus than to margin; in hind-wings the third anal vein is not forked; the intercubital line not distinct, broken by cells; in both wings the radial sector is much beyond the cubital fork.

Length fore-wing 22 to 29 mm., width 4.9 to 7 mm.

Length hind-wing 20 to 27 mm., width 4.2 to 5.8 mm.

Length abdomen 16 to 20 mm.

Specimens examined.—Va.: Cape Henry, July; Virginia Beach. N. C.: Southern Pines, May. Ga.: Millen, July. Fla.: St. Augustine; Biscayne Bay; Crescent City; Capron; Enterprise; and Lee Co. Tex.: Brazos Co.; Laredo; San Antonio; Brownsville. Also Lakehurst, New Jersey (Davis coll.), Beaufort, Raleigh, North Carolina (N. Car. state coll.), Sandy Hook, New York, Florida (Amer. mus. nat. hist.); St. Simon's Island, Georgia (Cornell univ.), Brownsville, Texas (Brooklyn mus., Snow coll.), Riverton, New Jersey (Johnson).

MYRMELEON RUSTICUS Hagen.

Synop., 1861, p. 233.

Face shining dark brown or black, the clypeus with two large dark spots; vertex reddish brown or black on the vertex rows; between with yellow spots, thus a yellow spot each side by eye, which normally is connected to a yellow spot between the inner and outer dark spots of first vertex row (but absent in the TYPE); two gray spots behind near middle, and a yellowish spot each side on the occiput. Pronotum with the lateral margin pale, a median spot in front, one each side, and a pair behind, sometimes these spots are connected; rest of notum dark, usually a pale median spot on the base of metanotum; pleura dark, with a few pale spots; hair of thorax white. Femora usually dark only near the tip, tibiae near base and at tip, often (especially in hind-tibia) with a streak below; tarsi mostly pale; bristles black. Abdomen brown or black, tips of some of the segments usually pale above; hair white, in the female that on the last ventral black. Wings with pale venation, dotted with dark, spotted on the larger veins, in more fully colored specimens than the TYPE some of the cross-veins are largely or wholly dark. Structure similar to *M. crudelis*, but the last joint of the labial palpi is more enlarged; the pronotum is broader, being plainly broader than long in the middle. Wings also similar to *M. crudelis*, but in the apical field there is a single series of gradate cross-veins.

Length fore-wing 25 to 29 mm., width 6 to 7.4 mm.

Length hind-wing 23 to 27 mm., width 5.2 to 6.2 mm.

Length abdomen 18 to 19 mm.

Specimens examined.—Tex.: Pecos River (TYPE). N. M.: Mesilla, June. Ariz.: Nogales, June; Phoenix, September. Utah: St. George,

June; Lion's Canyon, June; Coal Creek, Iron Co., June. Calif.: Claremont; Coronado Beach.

The type of *rusticus* is rather larger and not as fully colored as the forms I described as *distans* and *agriope*. The red-brown of *rusticus* is black in the latter forms. However I consider them all one species.

MYRMELEON DIVERSUS Hagen.

6th rept. U. S. G. S. territ., 1873, p. 729.

The single type from the Yellowstone agrees in general with *M. rusticus*, but is rather smaller, with the wings faintly marked. The vertex spots are the same as in *rusticus*, but the large spot on face does not reach the clypeus, and there is no dark on clypeus. The pronotum is almost wholly pale, with a dark stripe on each side; the posterior part of the mesonotum is pale, and there are pale spots on the sides of the anterior lobe, and the metascutellum is also partly pale. The last joint of the labial palpi is as in *M. rusticus*. Probably it is but an aberrant specimen of that species.

Length fore-wing 24 mm., width 6 mm.

The length hind-wing 22 mm., width 5.2 mm.

Length abdomen 18 mm.

ACANTHACLISINI.

Three genera are separated as follows:—

1. Fore-wings with but one series of costal cells; apical field scarcely widened beyond the stigma; last joint of labial palpi scarcely pedicellate; the spurs bent at an angle (Plate 2, fig. 46).....*Paranthaclisis*.
Fore-wings with two series of costal cells for most of the length; apical field plainly widened beyond stigma; last joint of labial palpi long pedicellate; spurs simply curved, not bent at angle (Plate 2, fig. 47).....2
2. Hind-wings with a distinct Banksian line.....*Heoclisis*.
Hind-wings without a Banksian line.....*Vella*.

PARANTHACLISIS Banks.

Ent. news., 1907, 18, p. 275.

Antennae fully diameter of basal joint apart; spurs strongly bent at an angle, and before the angle swollen on inner side, equal to three tarsal joints; last joint of labial palpi not pedicellate; pronotum much broader than long, and much broader behind than in front; abdomen

much shorter than wings; wings fairly broad, costal area simple, and beyond the stigma the area is but little widened, Banksian and intercubital lines fairly distinct in both pairs; cross-veins before radial sector rarely crossed; in fore-wings the third anal is usually forked, the second usually not forked but connected to first branch of the first anal.

TYPE.— *P. congener* (Hagen).

Two species are readily separated as follows:—

1. Many cross-veins slightly margined with dark, so the wings appear spotted; vertex spots dull black; several abdominal segments marked with pale at tip; male appendages rather longer than height of last segment..... *congener*.
Cross-veins not margined; spots of vertex shining black; abdominal segments at most faintly pale margined; male appendages rather shorter than the height of last segment..... *hageni*.

PARANTHACLISIS CONGENER (Hagen).

Acanthaclisis congener Hagen, Synop., 1861, p. 224.

Face yellowish; palpi pale; lower part of antennae pale, then annulate, and tip dark; vertex with large spot each side and median stripe dull black; pronotum dull black, four pale spots in front, the laterals more or less continued behind, two broad pale spots on the posterior border, and usually a minute pale dot in the middle of the black; rest of notum black, much spotted with pale, anterior lobe pale each side, mesoscutellum with pale spot each side behind; pleura mostly dark, a few pale spots; femora and much of tibiae dark above, latter usually pale at base and tip, tarsi mostly dark, except last joint, sometimes legs largely or wholly pale; hair on pleura and legs almost wholly white, some bristles on legs black; the metanotum has hair all white, but meso- and pronotum with much black hair through middle, white on sides. Abdomen dull black, two or three segments near tip with pale spot above; hair short, white, but in female the last few segments with much black hair.

The longitudinal veins of the wings with dark streaks, many cross-veins wholly dark and more or less margined with brown, so that the whole wing appears rather evenly spotted; hind-wings mostly unmarked, the veins being partly dark. About seven cross-veins before radial sector in the fore-wing, about six in hind-wing; nine branches to radial sector; usually a few cubitals connected; apical field with one row of cross-veins. Male appendages fully as long as height of the last segment; in the female the lower appendages are pale.

Length fore-wing 32 to 37 mm., width 9 to 11 mm.

Length hind-wing 30 to 35 mm., width 7.5 to 9 mm.

Length abdomen 25 to 27 mm.

Specimens examined.—Calif.: San Bernardino, July. Ariz.: Jerome, June; Verde River. Utah: Hurricane; Ore. Wash.: Ainsworth, July; Yakima River, July. Also Arizona (Amer. mus. nat. hist.), Nogales, Arizona (Cornell univ.), Las Cruces, New Mexico (N. M. agric. coll.).

PARANTHACLISIS HAGENI (Banks).

Acanthaclisis hageni Banks, Ent. news, 1899, 10, p. 170.

Face and palpi yellowish; antennae rather faintly annulate, tip dark; vertex with the spots deep shining black, with white hair between them; pronotum black, with four pale spots in front, the inner pair more separated than in *congener*, each side behind with a large pale spot, and two on the posterior border; rest of notum spotted much as in *congener*; pleura dark, scarcely spotted; femora mostly brownish, often darker above, tibiae also brownish, more evenly colored than in *congener*, tarsi black, hair on pleura and legs white, that on hind-legs less prominent, and with many black bristles; notum with white hair on the metanotum, that on middle area of pro- and mesonotum with much black hair mixed with the white. Abdomen black, unmarked, with very short white hair, in the female the last segments with mostly black hair. Venation of wings interruptedly black and whitish, many cross-veins wholly black, but not margined; about eight cross-veins before radial sector in the fore-wings, in hind-wings about six, about ten branches to the radial sector, usually two or three cubitals connected, one row of cross-veins in apical field. Male appendages parallel, shorter than height of the last segment; in female the lower appendages are black.

Length fore-wing 35 to 37 mm., width 9 to 10 mm.

Length hind-wing 32 to 35 mm., width 8 to 8.5 mm.

Length abdomen 22 to 24 mm.

Specimens examined.—Ariz.: Phoenix (TYPE); Safford. N. M.: Albuquerque, August. Tex.: Pecos, July. Also Kansas (Snow coll.), Santa Fe and Albuquerque, New Mexico (Cornell univ.), Mesilla, New Mexico (N. Mex. agric. coll.), Brownsville, Texas (Brooklyn mus.).

HEOCLISIS Navas.

Mem. Pont. acad. Rom. nuovi Lincei, 1923, ser. 2, 6, p. 12.

Antennae almost diameter of basal joint apart; last joint of labial palpi long pedicellate; spurs curved, about equal to three tarsal joints; pronotum about as long in middle as broad in front, but broader

behind; abdomen in both sexes much shorter than wings. Fore-wings with double costal series to near base, at least to origin of radial sector; beyond the stigma the area is much widened; the Banksian and intercubital lines distinct in both pairs; second anal vein not forked, but connected to first branch of the first anal vein, third anal forked. Usually some cubitals and some cross-veins before the radial sector in fore-wings are crossed.

TYPE.—*H. fundata* (Walker). Australia.

Acanthaclisis americana cannot remain in the typical genus if the group is divided into several genera, as is now generally accepted; it agrees well in with *Heoclis* which occurs in Asia and Australia.

HEOCLISIS AMERICANA (Drury).

Plate 2, fig. 47.

Myrmeleon americanum Drury, Ins., 1770, 1, p. 111, pl. 46, fig. 4.

Face yellowish; last joint of labial palpi mostly black; antennae scarcely annulate; front and vertex black, latter partly shining, a pair of faint pale submedian lines behind; pronotum gray, a basal median black stripe, and the lateral margins black; rest of notum black, with some gray areas, especially each side of mesoscutellum; pleura mostly gray, with black, and pale spots; femora brownish, tibia also, but banded with pale, tarsi black; long hair on legs, pleura, and metanotum white, on pronotum and mesonotum with black hair medially. Abdomen black, unmarked, white hair near base, black toward tip. Venation black and pale in patches, the radius and subcosta with many dark spots, and the space between largely black, space between medius and cubitus also mostly dark, beyond the rhagma two dark spots and a streak in the apex of wing, another about middle near hind-margin, and a spot at end of anal vein; some of the marginal forks are clouded; the cross-vein often wholly dark, but not margined; hind-wings with spot at rhagma, and the veins partly black.

Last joint of labial palpi long, pedicellate; antennae shorter than head and thorax, not very strongly clavate; abdomen much shorter than wings, male appendages longer than height of last segment, subparallel.

Fore-wings with double costal series to origin of radial sector; apical field with one row of cross-veins, about eleven cross-veins before radial sector in fore-wings, seven in hind-wings, ten branches to radial sector, usually some cubitals crossed, along the Banksian line are some hyaline dots on the cross-veins.

Length fore-wing 52 to 60 mm., width 13 to 16 mm.

Length hind-wing 49 to 57 mm., width 11 to 13.5 mm.

Length abdomen 32 mm.

Specimens examined.—N. C.: Newbern; Beaufort, September; Southern Pines, July, August. Ga.: Millen. Also Virginia, Norfolk (Chittenden). Florida (Acad. nat. sci. Phil.).

VELLA Navas.

Broteria, 1913, **11**, p. 46.

Antennae diameter of basal joint apart; last joint of labial palpi long pedicellate; spurs curved, about equal to three tarsal joints; pronotum broader than long, narrowed in front; abdomen of both sexes much shorter than the wings. Fore-wings with a double series of costal cells for usually more than one half-way to base; apical field much broadened beyond stigma; the Banksian and intercubital lines distinct in fore-wings, in hind-wings no sign of the Banksian line, the intercubital distinct; in fore-wings the second anal vein usually not forked, the third forked, the second connected to first branch of first anal. Usually some cubitals and some cross-veins before radial sector crossed.

TYPE.—*V. fallax* (Rambur).

Our three forms are closely related and may prove with more material to be but one variable species; they are separated as below:—

1. Pronotum with a median dark stripe, and the lateral margin dark, pale between; the abdomen mostly pale.....2
Pronotum with median and marginal stripes and also one each side between them; abdomen mostly dark; space between the radius and subcosta mostly dark.....*hesperus*.
2. The mesoscutellum largely dark; venation very dense; space between subcosta and radius little if any marked; male appendages shorter...*fallax*.
The mesoscutellum pale with middle stripe; venation more open; space between the subcosta and radius heavily marked; male appendages longer.....*texana*.

Of *V. texana* I have seen only the types, of *hesperus* only the three original specimens, and of *fallax* several from Mexico, but only one specimen from the United States. *V. texana* is the most heavily spotted, while *hesperus* has more evenly dark front-wings, *fallax* more faintly and irregularly marked. In *texana* and *hesperus* the space between the subcosta and radius is mostly dark, in *fallax* pale, rarely a few faint marks. In *texana* and *fallax* the pronotum has a dark median stripe

containing a pale line in front, and the side-margins dark; in *hesperus* there is besides a dark stripe on each side between the two. The abdomen of *hesperus* is mostly black, with narrow pale stripes; in *fallax* and *texana* it is mostly pale, with narrow dark stripes. The male appendages of *texana* and *hesperus* are a little longer than in *fallax*, *V. fallax* is more densely veined than the others.

In all the face is yellowish, the palpi pale, the last joint of labial palpi scarcely darkened, the vertex dull black, the notum of thorax black, with gray streaks and spots, the femora darkened above, the tibiae dark near base and at tip.

The fore-wings have a double series of costal cells rather more than one half-way to base, there are usually more than ten cross-veins before the radial sector, often several crossed, about nine branches to radial sector, the apical field with two rows of cross-veins; some of the cubitals connected; the subcosta and radius closely dotted with black; in hind-wings seven cross-veins before radial sector.

VELLA TEXANA (Hagen).

Acanthaclisis texana Hagen, Can. ent., 1887, **19**, p. 147.

Length fore-wing 55 mm., width 14 mm.

Length hind-wing 53 mm., width 10 mm.

Length abdomen 34 mm.

The type and others examined are from Carrizo Springs, Texas.

VELLA FALLAX (Rambur).

Myrmeleon fallax Rambur, Hist. ins. Névr., 1842, p. 385.

The only specimen from the United States is from Phoenix, Arizona, it is smaller than Mexican specimens.

Length fore-wing 48 mm., width 11 mm.

Length hind-wing 45 mm., width 8 mm.

Length abdomen 30 mm.

VELLA HESPERUS (Banks).

Acanthaclisis hespera Banks, Proc. Acad. nat. sci. Phil., 1914, p. 618.

Measurements about as in *texanus*.

The types are from Jemez Mts., N. Mex. Another from Nogales, Arizona, July (Cornell univ.).

EXPLANATION OF PLATES.

PLATE 1.

PLATE 1.

- Fig. 1. *Hesperoleon papago*, vertex and pronotum.
- Fig. 2. *Hesperoleon coquilletti*, vertex and pronotum.
- Fig. 3. *Hesperoleon yavapai*, vertex and pronotum.
- Fig. 4. *Hesperoleon irregularis*, vertex and pronotum.
- Fig. 5. *Hesperoleon abdominalis*, vertex and pronotum.
- Fig. 6. *Hesperoleon niger*, vertex and pronotum.
- Fig. 7. *Hesperoleon minuseulus*, vertex and pronotum.
- Fig. 8. *Hesperoleon maculosus*, vertex and pronotum.
- Fig. 9. *Hesperoleon nigrilabris*, vertex and pronotum.
- Fig. 10. *Hesperoleon tenuis*, vertex and pronotum.
- Fig. 11. *Hesperoleon texanus*, vertex and pronotum.
- Fig. 12. *Hesperoleon sackeni*, vertex and pronotum.
- Fig. 13. *Hesperoleon hubbardi*, vertex and pronotum.
- Fig. 14. *Hesperoleon brunneus*, vertex and pronotum variations.
- Fig. 15. *Brachynemurus elongatus*, pronotum.
- Fig. 16. *Hesperoleon douglasi*, pronotum.
- Fig. 17. *Hesperoleon ferox*, pronotum.
- Fig. 18. *Hesperoleon abdominalis*, pronotum.
- Fig. 19. *Hesperoleon assimilis*, pronotum.
- Fig. 20. *Hesperoleon carrizonus*, pronotum.
- Fig. 21. *Netroneurus carolinus*, pronotum.
- Fig. 22. *Austroleon dorsalis*, vertex and pronotum.
- Fig. 23. *Hesperoleon versutus*, vertex and pronotum.

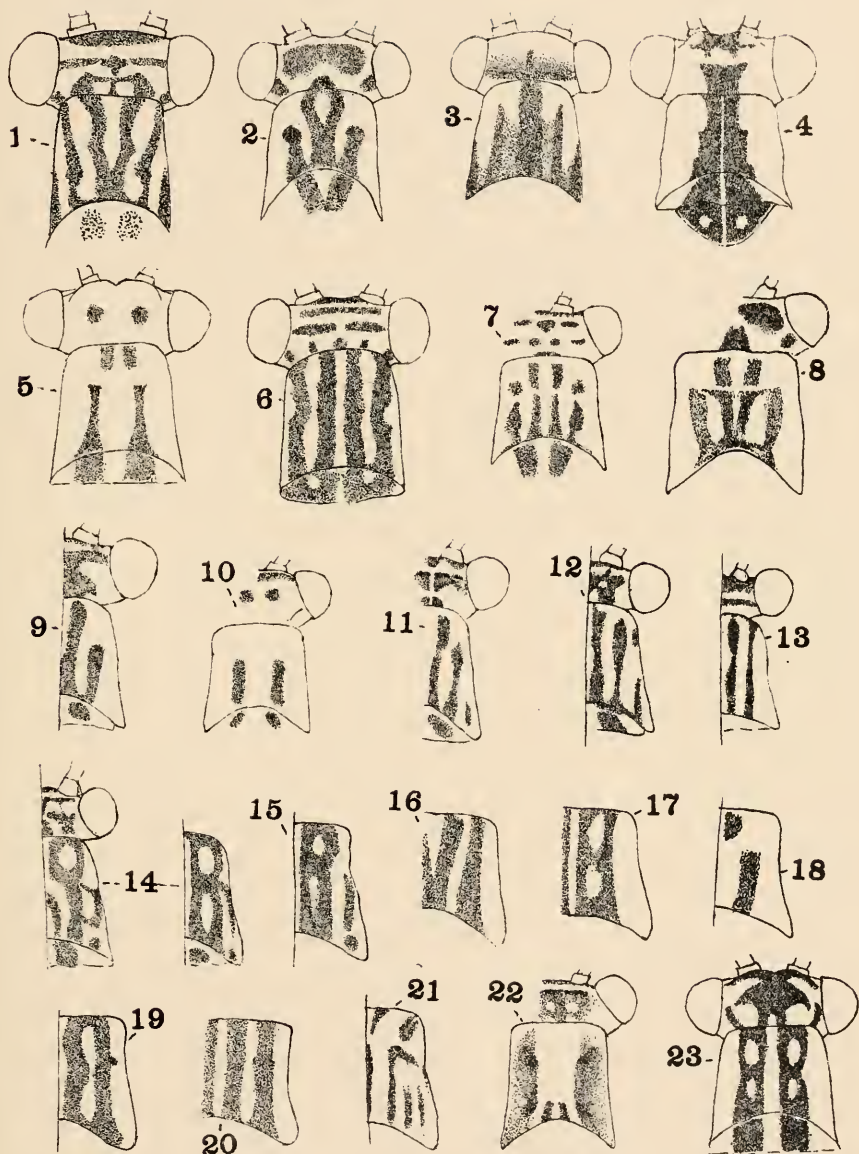


PLATE 2.

PLATE 2.

- Fig. 24. *Austroleon barberi*, vertex and pronotum.
- Fig. 25. *Netroneurus pulchellus*, vertex and pronotum.
- Fig. 26. *Eremoleon nigribasis*, vertex and pronotum.
- Fig. 27. *Chaetoleon pusillus*, vertex and pronotum.
- Fig. 28. *Brachynemurus longicaudus*, vertex and pronotum.
- Fig. 29. *Cryptoleon henshawi*, vertex and pronotum.
- Fig. 30. *Clathroneuria delicatulus*, vertex and pronotum.
- Fig. 31. *Eremoleon macer*, vertex and pronotum.
- Fig. 32. *Psammoleon minor*, male appendages.
- Fig. 33. *Psammoleon bistictus*, male appendages.
- Fig. 34. *Psammoleon sinuatus*, male appendages.
- Fig. 35. *Psammoleon connexus*, male appendages.
- Fig. 36. *Myrmeleon immaculatus*, anal area of hind-wings.
- Fig. 37. *Myrmeleon crudelis*, anal area of hind-wings.
- Fig. 38. *Psammoleon guttipes*, male appendages.
- Fig. 39. *Eremoleon macer*, anal area of fore-wing.
- Fig. 40. *Chaetoleon pumilis*, anal area of fore-wing.
- Fig. 41. *Dendroleon speciosum*, anal area of fore-wing.
- Fig. 42. *Psammoleon minor*, spurs.
- Fig. 43. *Psammoleon guttipes*, spurs.
- Fig. 44. *Psammoleon connexus*, spurs.
- Fig. 45. *Glenurus gratus*, anal area of fore-wing.
- Fig. 46. *Paranthaclisis*, spurs and labial palpus.
- Fig. 47. *Heoclisis americana*, spurs and labial palpus.

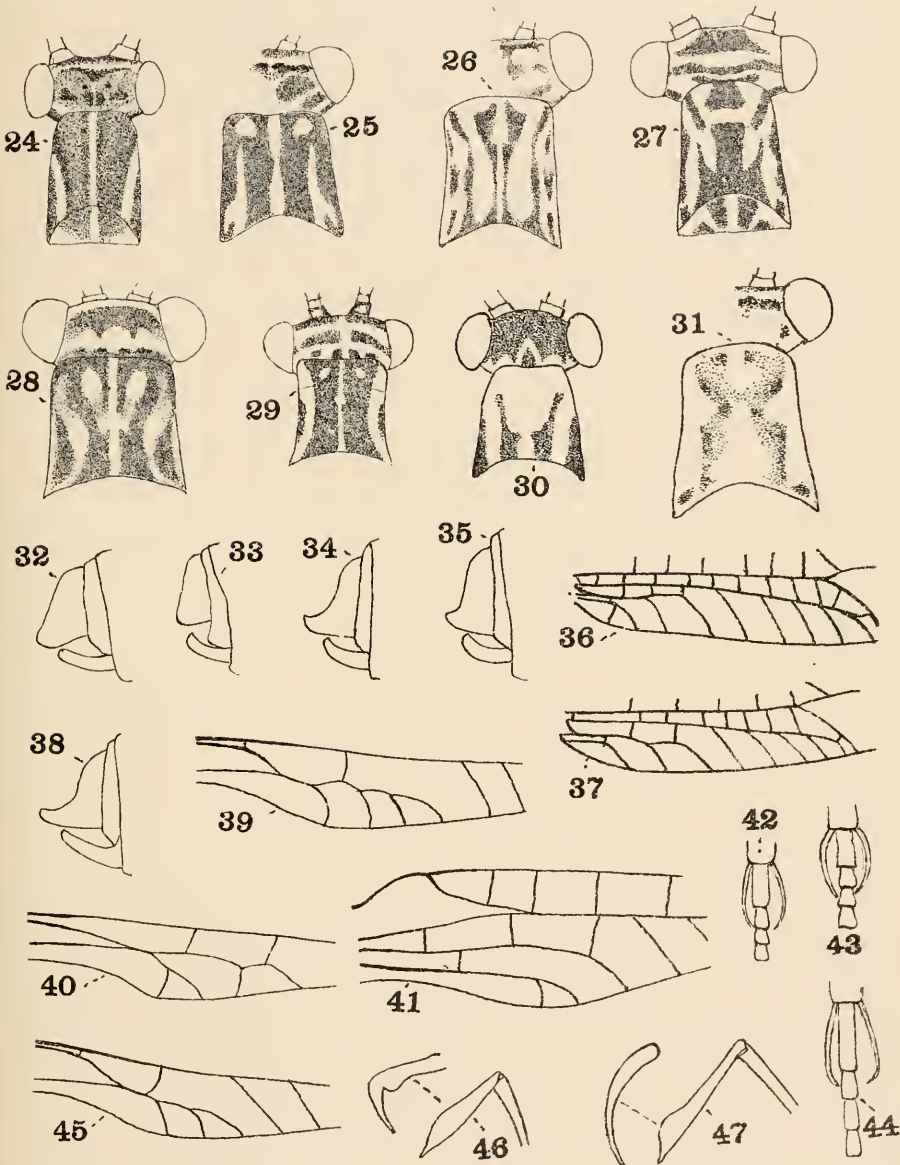


PLATE 3.

PLATE 3.

- Fig. 48. *Hesperoleon sackeni*, tip abdomen, male.
- Fig. 49. *Cryptoleon nebulosum*, tip abdomen, male.
- Fig. 50. *Cryptoleon signatum*, tip abdomen, male.
- Fig. 51. *Hesperoleon pallidus*, tip abdomen, male.
- Fig. 52. *Hesperoleon nigrilabris*, tip abdomen, male.
- Fig. 53. *Hesperoleon abdominalis*, tip abdomen, male.
- Fig. 54. *Hesperoleon minusculus*, tip abdomen, male.
- Fig. 55. *Cryptoleon henshawi*, tip abdomen, male.
- Fig. 56. *Cryptoleon nebulosum*, labial palpus.
- Fig. 57. *Brachynemurus elongatus*, tip abdomen, male.
- Fig. 58. *Brachynemurus ramburi*, tip abdomen, male.
- Fig. 59. *Hesperoleon niger*, labial palpus.
- Fig. 60. *Hesperoleon maculosus*, hind tarsus.
- Fig. 61. *Hesperoleon carrizonus*, tip abdomen, male.
- Fig. 62. *Hesperoleon singularis*, tip abdomen, male.
- Fig. 63. *Hesperoleon douglasi*, tip abdomen, male.
- Fig. 64. *Hesperoleon abdominalis*, tip abdomen, male.
- Fig. 65. *Hesperoleon assimilis*, tip abdomen, male.
- Fig. 66. *Hesperoleon pallidus*, front of head.
- Fig. 67. *Hesperoleon minusculus*, hind tarsus.
- Fig. 68. *Scotoleon longipalpis*, labial palpus.
- Fig. 69. *Brachynemurus tuberculatus*, tip abdomen, male.
- Fig. 70. *Brachynemurus longicaudus*, tip abdomen, male.
- Fig. 71. *Hesperoleon ferox*, tip abdomen, male.
- Fig. 72. *Brachynemurus tuberculatus*, front of head.
- Fig. 73. *Hesperoleon singularis*, front of head.
- Fig. 74. *Netroneurus carolinus*, front of head.

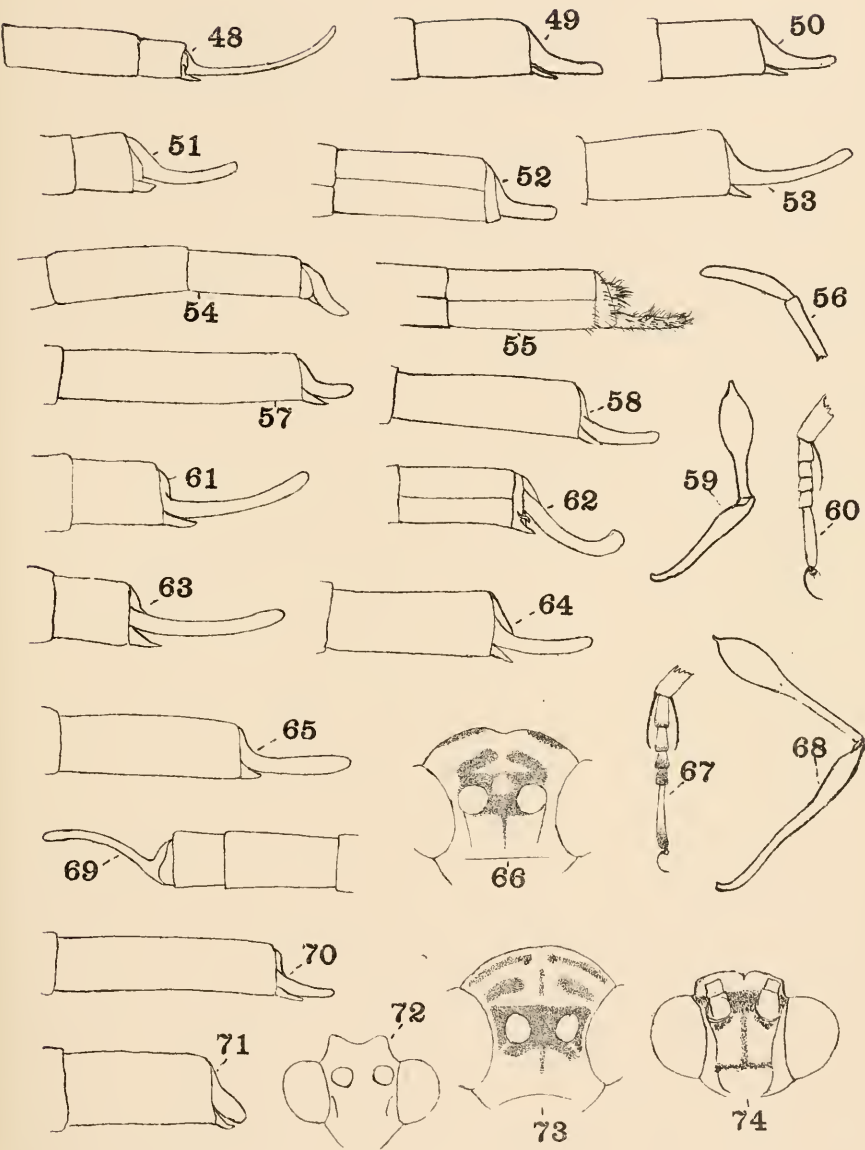
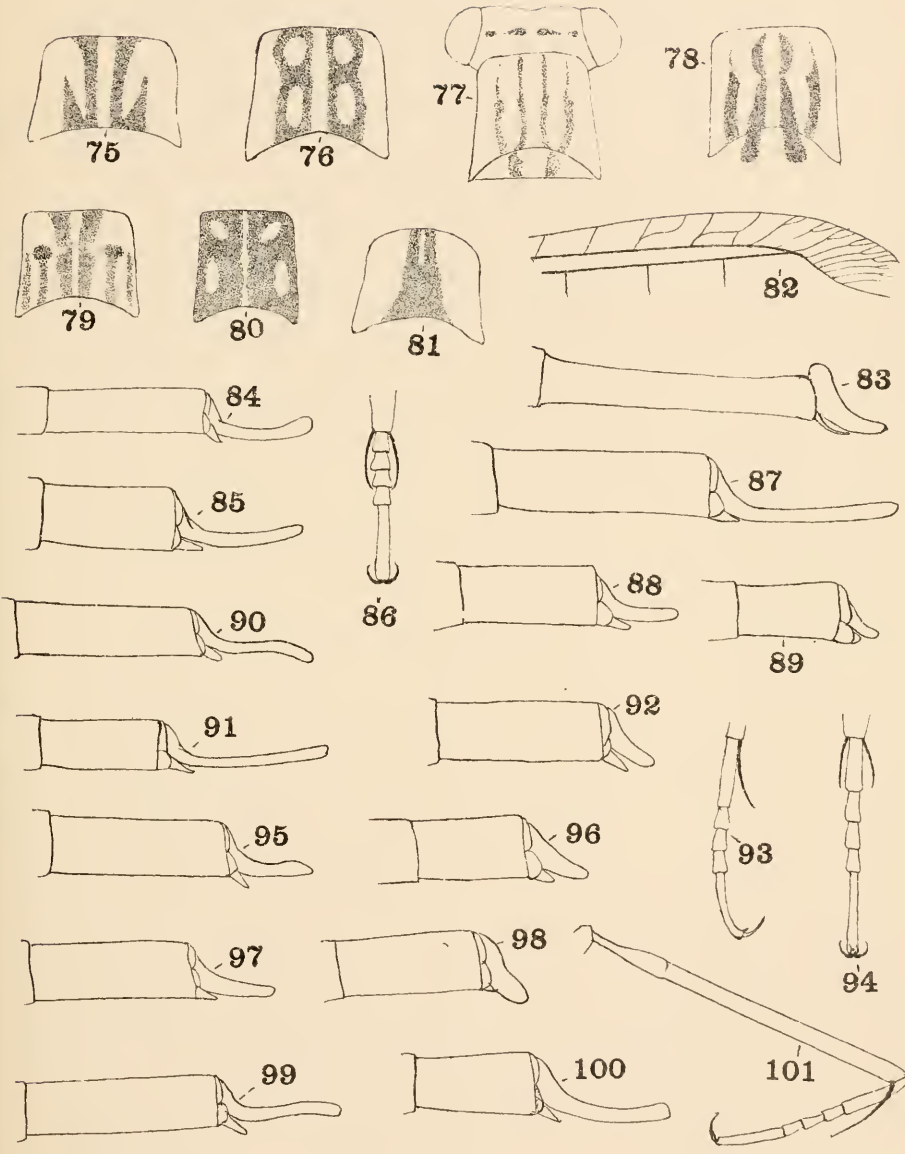


PLATE 4.

PLATE 4.

- Fig. 75. *Hesperoleon blandus*, pronotum.
- Fig. 76. *Hesperoleon intermedius*, pronotum.
- Fig. 77. *Hesperoleon quadripunctatus*, pronotum.
- Fig. 78. *Hesperoleon singularis*, pronotum.
- Fig. 79. *Clathroneuria schwarzi*, pronotum.
- Fig. 80. *Puren inscriptus*, pronotum.
- Fig. 81. *Myrmeleon texanus*, pronotum.
- Fig. 82. *Hesperoleon yavapai*, hind-wing, apical area.
- Fig. 83. *Austroleon dorsalis*, male abdomen, tip.
- Fig. 84. *Hesperoleon blandus*, male abdomen, tip.
- Fig. 85. *Hesperoleon versutus*, male abdomen, tip.
- Fig. 86. *Hesperoleon coquilletti*, front tarsus.
- Fig. 87. *Hesperoleon mexicanus*, male abdomen, tip.
- Fig. 88. *Hesperoleon intermedius*, male abdomen, tip.
- Fig. 89. *Hesperoleon coquilletti*, male abdomen, tip.
- Fig. 90. *Hesperoleon hubbardi*, male abdomen, tip.
- Fig. 91. *Hesperoleon yavapai*, male abdomen, tip.
- Fig. 92. *Scotoleon longipalpis*, male abdomen, tip.
- Fig. 93. *Puren inscriptus*, hind tarsus.
- Fig. 94. *Hesperoleon irregularis*, front tarsus.
- Fig. 95. *Hesperoleon hubbardi curtus*⁶, male abdomen, tip.
- Fig. 96. *Hesperoleon quadripunctatus*, male abdomen, tip.
- Fig. 97. *Hesperoleon brunneus*, male abdomen, tip.
- Fig. 98. *Hesperoleon texanus*, male abdomen, tip.
- Fig. 99. *Clathroneuria schwarzi*, male abdomen, tip.
- Fig. 100. *Calinemurus fuscus*, male abdomen, tip.
- Fig. 101. *Dendroleon obsoletum*, hind tibia and tarsus.



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THE DISTRIBUTION AND RELATIONSHIPS
OF THE TRINUCLEIDÆ.

BY HENRY C. STETSON.

WITH ONE PLATE.

CAMBRIDGE, MASS., U. S. A.:
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No. 2.— *The Distribution and Relationships of the Trinucleidae.*

BY HENRY C. STETSON.

THIS study is an attempt to trace the migrations of the members of a family of trilobites from the time of their first appearance to extinction. Such an attempt involves the assembling of a list of the species, with their geological and geographical distribution, and the correlation of the strata in which they occur in various countries. Furthermore, it was necessary to ascertain which characteristics are primitive and which specialized in the family, and the relationships of the species to one another. This involved a study of the ontogeny and phylogeny. I have applied Raymond's generic criteria to all known species, and have indicated such modifications as it seems necessary to make in the existing scheme. Starting with the most primitive forms, I have tried to trace the hypothetical lines of evolution, with especial reference to places of origin and migration.

To Dr. Raymond's constant advice and criticism this paper is largely due. I wish to thank Dr. F. R. C. Reed for his kindness in allocating some of the British species to their proper horizons.

The Trinucleidae were grouped by Raymond (35) in three genera, Trinucleus, Cryptolithus, and Tretaspis. In addition to the characteristics noted by him, I have paid especial attention to the structure of the brim, this proving to be a feature of great importance in working out the phylogeny.

Tretaspis has a flask-shaped glabella, deep glabellar furrows, and simple eyes, which persist to the adult stage. The brim is marked by concentric rows of pits. *Tretaspis seticornis* (Hisinger) is the type. Trinucleus has a similar flask-shaped glabella, bearing furrows. It is distinguished by a much more simple type of brim, with radial furrows. It lacks eyes and eye-lines. The type is *Trinucleus fimbriatus* Murchison. Cryptolithus has a large glabella, not constricted at its posterior end, and with the glabellar furrows shown by very faint grooves or spots. The wide brim has numerous concentric rows of small pits. The type is *Cryptolithus tessellatus* Green. Reed's (47, p. 118) three groups, distinguished by the ornamentation in the genal areas, correspond in the main with Raymond's, although based on different characteristics. His Group I is the equivalent of Trinucleus, Group II of Tretaspis, and Group III of Cryptolithus. However, Reed

only applied this classification to a few English species, and it is impossible to tell from figures alone, whether or not it would hold for other species in other countries.

LIST OF THE SPECIES OF THE TRINUCLEIDAE, WITH THEIR GEOLOGIC RANGES.

ARENIG.

ENGLAND: — *Trinucleus murchisoni* Salter, from the Shelve Region of Shropshire.

WALES: — *Trinucleus murchisoni* Salter, from Montgomeryshire; *Trinucleus gibbsii* Salter, *Trinucleus sedgwicki* Salter, and *Trinucleus etheridgi* Hicks, from St. David's Head, Pembrokeshire.

LLANDEILO.

ENGLAND: — *Cryptolithus lloydii* (Murchison), from the mining district of Shropshire; *Cryptolithus favus* (Salter) from Meadowtown.

WALES: — *Cryptolithus lloydii* (Murchison) from Carmarthenshire; *Cryptolithus favus* and *Trinucleus fimbriatus* Murchison, from Builth.

SCOTLAND: — *Tretaspis subradiata* (Reed) from the Balclatchie beds of the Girvan District.

IRELAND: — *Cryptolithus thersites* (Salter) from Tramore, *Trinucleus fimbriatus* Murchison, from Wexford, Tyrone, and Wicklow, and *Trinucleus hibernicus* Reed from Tramore.

BALA OR CARADOC.

ENGLAND: — *Cryptolithus caractaci* (Murchison) from Onney River, Shropshire, and Cheney Longville; *Cryptolithus nicholsoni* (Reed) from the Dufton Shales near Melmerby, Cumberland.

WALES: — *Cryptolithus caractaci* (Murchison) from the Sholeshook limestone, Pembrokeshire; *Cryptolithus intermedius* (Wade), and *Cryptolithus arcuatus* (Smith) from Trilobite Dingle, Montgomeryshire; *Cryptolithus gibbifrons* (McCoy) Caradoc sandstone; *Tretaspis radiata* (Murchison) from Welshpool, and the Caradoc and Meifod Hills.

SCOTLAND: — *Trinucleus albidus* Reed from the Whitehouse Group, Girvan District.

IRELAND: — *Cryptolithus elongatus* (Portlock) from Tyrone and Pomeroy; *Cryptolithus caraetaci* (Murchison) from Wexford, Tyrone, and Waterford; *Trinucleus latus* Portlock from Tyrone; and *Tretaspis portrainensis* (Reed) from Dublin County.

ASHGILLIAN.

ENGLAND: — *Tretaspis seticornis* (Hisinger) from the Coniston limestone.

SCOTLAND: — *Tretaspis seticornis* and *Tretaspis bucklandi* (Barrande) from the Drummock Group, Girvan District.

IRELAND: — *Tretaspis seticornis* from Pomeroy, Chair of Kildair, Wexford, Tyrone; *Cryptolithus portlocki* (Salter) from Tyrone and Pomeroy; *Cryptolithus arcuatus* (Smith) from Pomeroy.

ARENIG.

FRANCE: — *Cryptolithus primitivus* (Born) from Montagnes Noires.

LLANDEILO. SCHISTES À CALYMENES.

FRANCE: — *Cryptolithus bureauvi* (Oehlert) from the top of the ardoises d'Angers at Andouille, and also from the Valley of the Laize in the lower part of the Grès de May, with *Synhomalonotus tristani*; *Cryptolithus grenieri* (Bergeron) Schistes d'Ecalgrain, Manche, where it is associated with the group of *Synhomalonotus tristani* (Oehlert 30, p. 307); *Cryptolithus goldfussi* (Barrande) from the Grès de Bas Pont near Vitré, at the top of the Grès de May.

BALA. SANDSTONES OF RIADAN.

FRANCE: — *Cryptolithus pongerardi* (Rouault) from Ille-et-Vilaine in the Grès de Bas Pont (*i.e.*, top of the Grès de May), as far as the schistes ardoisiers superieurs de Riadan and of Renaze; *Cryptolithus goldfussi* from the same horizon, and *Cryptolithus ornatus* (Sternberg) associated with it; *Cryptolithus seunesi* (Kerforne) from May sur Orne.

ASHGILLIAN.

FRANCE: — *Tretaspis seticornis* (Hisinger) from the Ardennes.

D 1 γ

BOHEMIA: — *Trinuclcoides reussi* (Barrande); *Trinuclcus praececdens* Kloucek.

D 2

BOHEMIA: — *Cryptolithus goldfussi* (Barrande); *Cryptolithus alfredi* (Zelizko).

D 3

BOHEMIA: — *Cryptolithus goldfussi* (Barrande).

D 4

BOHEMIA: — *Cryptolithus ornatus* (Sternberg); *Cryptolithus goldfussi* (Barrande).

D 5

BOHEMIA: — *Cryptolithus goldfussi* (Barrande); *Cryptolithus ornatus* (Sternberg); *Cryptolithus ultimus* (Barrande); *Tretaspis bucklandi* (Barrande).

LOWER DICELLOGRAPTUS ZONE.

SWEDEN: — *Trinuclcus coseinorrhinus* Angelin; Fogelsång in Scania, *Trinuclcus efflorescens* Hadding from Jemtland.

LOWER CHASMOPS ZONE.

SWEDEN: — *Tretaspis carinata* (Angelin) and *Tretaspis cerioides* (Angelin) from Kinnekulle, Vastergotland.

NORWAY: — *Tretaspis wahlenburgi* (Rouault) and *Trinuclcus bucculentes* Angelin from the Oslo District; *Trinuclcus forcolatus* Angelin from the Ogygia shale, 50 miles north of Oslo.

TRINUCLEUS SHALE.

SWEDEN: — *Tretaspis affinis* (Angelin) from Dalecarlia; *Tretaspis cerioides* (Angelin) from Kinnekulle, Vastergotland; *Tretaspis bucklandi* (Barrande) from Scania; *Tretaspis cliptifrons* (Olin) from Scania; *Tretaspis wahlenburgi* (Rouault) from Mosseburg, Billingen, and Alleberg in Vastergotland; *Tretaspis seticornis* (Hisinger, from Draggabro, Furndal; *Tretaspis latilimba* (Linnarsson) from Scania.

NORWAY: — *Tretaspis seticornis* (Hisinger) from the Oslo District.

DENMARK: — *Tretaspis wahlenburgi* (Rouault) and *Tretaspis bucklandi* (Barrande) from Bornholm.

ESTHONIA: — *Tretaspis seticornis* (Hisinger) from Lyckholm strata, western Esthonia.

ORDOVICIAN SUPERIEUR.

PORTUGAL: — *Cryptolithus pongerardi* (Rouault); *Cryptolithus goldfussi* (Barrande) from Bussaco; *Cryptolithus bureaui* (Oehlert) from Bussaco and Tagus Basin; *Cryptolithus seunesi* (Kerforne) from Tagus Basin.

NORMANSKILL.

U. S. A.: — *Trinucleus diademata* (Ruedemann) and *Tretaspis reticulata* Ruedemann from Rysedorph Hill, near Albany, N. Y.; *Trinucleus acervulosus* Raymond from the Athens of central Virginia and eastern Tennessee.

TRENTON.

U. S. A.: — *Cryptolithus tessellatus* Green, 40 to 80 feet above the base of the Trenton at Quebec, Montreal, Champlain Valley, Saratoga, and in the Mohawk Valley, Amsterdam to Trenton Falls; 150 feet above the base of the Trenton at Martinsburg, N. Y.; 50 feet above the base of the Trenton in northwestern New Jersey and northeastern Pennsylvania; at the base of the Trenton at Bellefonte, Pa., and for 40 miles south; 125 feet above the base of the Trenton in Catawba Valley, Va., and continues at same horizon southward along the line of strike to about 50 miles north of Knoxville, Tenn.; 25 feet above the base of the Trenton in central Kentucky near Frankfort; Viola limestone of Oklahoma; top of the Trenton in Kentucky on the Ohio River in the vicinity of Cincinnati, at Bellefonte, Pa., and the Appalachian Valley from Chambersburg, Pa. to Staunton, Va.; *Cryptolithus bellulus* (Ulrich) from the Eden of the Cincinnati District, and the Mohawk Valley in New York.

LORRAINE.

U. S. A.: — *Cryptolithus lorraineensis* (Ruedemann) west of Adirondacks of New York.

CORRELATION.

In correlating I have taken English series as a basis. Only those strata containing the Trinucleidae are considered.

The identification of the Arenig in France and Bohemia is at best complicated. Poeta (32, p. 137), having studied the Ordovician of the west of France with Oehlert, says that it is impossible to correlate directly between France and Bohemia. The lowest stage in Bohemia, D1, is divided into three parts α , β , and γ . D1 β at Rokycan contains the Euloma-Niobe fauna which is lowest Arenig (Holub, 19). D1 β is therefore older than the Arenig Trinucleus horizons of Wales, and older than the horizon of *Cryptolithus primitivus* of the Montagnes Noires. The crux of the situation is whether D1 γ is upper Arenig or lower Llandeilo. Until more work is done, the question rests on a rather unsatisfactory basis. D1 γ comes directly above β so that from its position it might be judged to be Arenig. Brögger (8) lists from it the typical Arenig trilobites:—Asaphellus, Megalaspis, and Platypeltis. With them occur *Didymograptus geminus*, and *Cryptograptus tricornis*, which are supposedly guide fossils to the lower Llandeilo. He is of the opinion that the trilobites are more to be relied on. Frech (11, p. 112–115) likewise puts it in the Arenig. I find the same situation in France, where the lowest beds of the Calymene schists (slates of Angers) contain *Didymograptus murchisoni*, *D. nanus*, *D. euodus*, and *D. fureillatus*, most of which are Arenig, but, nevertheless, have *D. murchisoni* associated with them (Barrois 4, p. 75–191). This horizon is the equivalent of D1 γ , and they must be either both Arenig or both Llandeilo. In the Calymene schists, *Synhomalonotus arago* characterizes the base and *S. tristani* the summit (Haug, 15, p. 636), and it is with the latter that *Cryptolithus bureaui* and *C. grenieri* are associated. Whatever the age of the bottom of the Calymene schists may be, there is no doubt but that the top is Llandeilo. The consensus of opinion seems to be that D1 γ is Arenig and is so considered here.

Another Arenig species that has caused uncertainty is *Cryptolithus primitivus*, from the Montagnes Noires. Born (7) states that it occurs with Phyllograptus which should put it definitely in the Arenig. But the trilobites with it are the Llandeilo species, *Dalmanites socialis*, *Ogygia glabrata*, and *Synhomalonotus arago*. However, as Phyllograptus is so good a guide fossil, I have accepted it as Arenig.

There seems to be no difficulty with the Llandeilo. Frech (11, p. 112–115) says it corresponds with D2 in Bohemia. In Scandinavia it corresponds with the lower Dicellograptus zone, and with the Norman-

skill in the United States (Raymond, 37). I have already taken up the case of France.

The Bala according to Frech (11, p. 112-115) corresponds with D3 and D4 in Bohemia. It is in D4 that *Cryptolithus ornatus* first appears associated with *C. goldfussi*; *C. goldfussi* first occurs in Bohemia in D2, and in France in the sandstones of Bas Pont (*i.e.*, at the top of the Grès de May) (Haug, 15, p. 636). In the latter case *C. goldfussi* continues up to the upper slaty shales of Riadan where *C. ornatus* is associated with it (Oehlert, 30, p. 310). Therefore, D4 is probably the equivalent of this latter horizon. Furthermore, *C. pongerardi* occurs in the sandstones of Riadan which is just above the Grès de May (Haug, 15, p. 636), and which in many cases terminates the upper Ordovician (Oehlert, 30, p. 310). Geikie (12, p. 972) considers this Bala. The Bala is also the equivalent of the Chasmops beds in Scandinavia, and of the Trenton in the United States (Raymond, 37).

Except in the United States, the Ashgillian is characterized by *Tretaspis seticornis*. It is probably the equivalent of D5 in Bohemia, and of the Trinucleus shale in Scandinavia. In France there is but one occurrence of *T. seticornis*, in the Ardennes. Elsewhere the Ashgillian seems to be lacking.

In Portugal, I have taken Delgado's Ordovicien superieur to be the equivalent of the Bala. There is no evidence from other fossils associated with the Trinucleidae that it can be the equivalent of the Ashgillian. Therefore, as *Cryptolithus pongerardi* and *C. seunesi* occur in France in what is the equivalent of the Bala, this also is probably Bala. *Cryptolithus goldfussi* occurs in the equivalent of the Llandeilo, as well as the Bala, but on this basis *C. bureaui* would occur in France at a lower horizon than in Portugal.

ONTOGENY.

As the ontogeny of only two species of *Cryptolithus* has been studied, very little information can be derived from this source. The young of *Cryptolithus tessellatus* described by Beecher show the "eye-lines." In the specimen figured (Beecher, 5, pl. 3, fig. 1), the brim is narrow with only two rows of pits. A more complete series of specimens shows the ontogeny of *Cryptolithus ornatus* from Bohemia. The specimens range from the brimless forms, through those with a narrow brim bearing a single row of pits, to individuals with the brim fully developed. As the young get larger, the brim grows, and successive rows of pits appear. Eyes and eye-lines are lacking in *C. ornatus* at all stages.

I have had opportunity to study many young of this species from specimens in the M. C. Z. and was able to assemble such a series as Barrande (2, pl. 30) figured.

From their first appearance, the Trinucleidae are a highly specialized family. The later species differ from the earlier only in the form of the brim, this being the one feature that shows any progressive modification. All four genera seem to point to a Cambrian ancestral type with a narrow brim, either unornamented, or with a single row of small pits. The glabella possibly was constricted at the neck and carried furrows, although the youngest forms figured by Barrande show no trace of these features. It may not have been as prominent as is the case with later forms. Simple eyes may or may not have been present. The earlier species show no trace of "eye-spots." In attempting to trace the line of descent the Arenig species are of course the most important. Unfortunately this horizon is the most poorly represented, which adds a considerable degree of uncertainty to the transition into the Llandeilo.

The four British species of *Trinucleus* that appear in the Arenig do not bear out the ontogeny to any marked extent. The brim is wide in *T. sedgwicki* and *T. gibbsi* (Plate, fig. 2, 3) and bears at least four rows of pits set in faint radial furrows. In *T. etheridgi* and *T. murchisoni* (Plate, fig. 1) it is narrow, but can scarcely be called simple, bearing as it does deep radial furrows, bifurcating in front. All that can be inferred from ontogeny at the most is that the hypothetical ancestor of this family was a form with a narrow brim, unornamented, or bearing a single row of pits, that the head-shield and pygidium would be equal in size, and the glabella unsegmented. *Trinucleus*, on the whole, is more primitive than either *Cryptolithus* or *Tretaspis* in that the brim is relatively smaller and less specialized. Geologically it was the first to appear and the first to become extinct. In discussing known trilobites as hypothetical ancestors, certainly *Eodiscus* conforms with the hypothetical ancestor suggested by the ontogeny better than any other form. It has the head-shield and pygidium of equal size, the brim is narrow and bears a single row of furrows or pits, and the glabella is unfurrowed. *Orometopus* on the other hand has none of the characteristics of the young stages, and its supposed ancestral position seems to be inferred merely from a general resemblance in shape to the adult Trinucleid.

PHYLOGENY.

The oldest members of the family, the four British species of *Trinucleus* from the Arenig, fall into two natural groups as described

above, using the brim as a basis of subdivision. *Trinucleus praececdens* from D1 γ in Bohemia is not figured, but as nearly as I can make out from the description, it is much like *T. murchisoni*. As one ascends higher in the stratigraphic series, it becomes increasingly apparent that the nature of the brim is an important means of holding like species together.

Starting from one of the two distinct types of *Trinucleus* in the Arenig, a possible line of descent of *Cryptolithus* can be seen. In *Cryptolithus* the brim is wide, bearing numerous rows of pits, arranged concentrically, although in some species it is possible to trace a radial arrangement as well. This is most marked directly in front of the glabella. *Cryptolithus earactaci*, typical *C. favus*, *C. alfredi*, *C. goldfussi*, *C. grenieri*, *C. bureauvi*, *C. thersites*, and *C. lloydi* are the probable descendants in the Llandeilo of the *gibbsii-sedgwicki* division of *Trinucleus*. A loss of glabellar furrows in these two species, the addition of one or more rows of pits, and the slight disturbance of their radial arrangement would give the typical *Cryptolithus* brim. This line continues unbroken into the Bala, being represented by *Cryptolithus discors*, *C. intermedius*, *C. bellulus*, *C. pongerardi*, *C. goldfussi*, *C. ornatus*, *C. scunesi*, *C. tessellatus*, *C. nicholsoni*, *C. elongatus*, and *C. gibbifrons*, and so into the Ashgillian, ending with *C. ultimus*. In certain of these species, notably *C. intermedius*, *C. lloydi*, and *C. nicholsoni*, traces of the radial arrangement of pits are still visible, and undoubtedly an examination of the actual specimens would reveal others showing it.

Another major line of evolution is that of *Tretaspis*, characterized by *T. seticornis* or its variety *T. bucklandi* (Plate, fig. 6). The brim has an outer and inner portion, the former usually consisting of one or two rows of large pits sunk in short, radial furrows. The inner portion bears several rows of smaller pits, more or less radially arranged on the anterior part of the brim, becoming very irregular at the genal angles. The glabella is markedly flask-shaped, and bears strong furrows. Eye-spots and a median pustule are present. *Tretaspis* occurs in the Llandeilo of Scotland (*T. subradiata*), but in a form so divergent from the type, i.e., *T. seticornis*, that it cannot be considered as a direct ancestor of the Bala species. *Tretaspis subradiata* differs from the type in having an extraordinarily wide inner brim, bearing numerous fine pits arranged in distinct radial rows. It resembles very closely *T. radiatus* of the Bala of Wales and was probably ancestral to this species. A species of *Tretaspis*, *T. reticulata* (Plate, fig. 7), occurs in the equivalent of the Llandeilo in the United States, namely, the Normanskill. This species conforms to the type, but could scarcely be considered an-

cestral to the European forms. For the ancestor both of the European and North American species we should expect a *seticornis*-like form in the lower Llandeilo or upper Arenig. This hypothetical species yet remains to be discovered. In the Bala we have *Tretaspis cerioides*, *T. wahlenbergi*, *T. portrainensis*, and *T. radiatus*, and in the Ashgillian *T. seticornis*, *T. cerioides*, *T. affinis*, *T. bucklandi*, *T. elliptifrons* and *T. wahlenbergi* in good succession. Their line of descent cannot be traced back of the Llandeilo with any degree of certainty. The enlarged section of the brim of *Trinucleus sedgwicki*, as figured by Salter (Plate, fig. 2), seems to show a tendency towards differentiation into an inner and outer brim. On the other hand, the second group of Arenig Trinuclei bears pits at the bottom of their bifurcating radial furrows. As Professor Raymond recently suggested, partial elimination of these furrows would leave the pits in the arms of the "Y" offset from the main line, which might conceivably be the start of a differentiation between the inner and outer brim. *Trinucleus etheridgi* carries on the underside of the brim long ridges with intercalated shorter ones, which show at least a tendency toward this differentiation.

Trinucleus is represented in the Llandeilo by *T. fimbriatus* as the type (Plate, fig. 5). The brim is relatively narrow, and strongly furrowed radially, the furrows usually bearing pits at the bottom. They become obliterated toward the genal angles, and their place is taken by very narrow, V-shaped furrows bearing pits at the bottom. The glabella is flask-shaped, and strongly furrowed. Eye-spots are lacking. *Trinucleus diademata* (Plate, fig. 9), *T. acervulosus*, and *T. efflorescens* belong to this group. In *T. efflorescens*, and in *T. albidus* of the Bala, the radial grooves become much less marked and the pits more prominent. The glabellar furrows are faint. This is especially true of *T. efflorescens* where there is a concentric arrangement of pits as well (Plate, fig. 4).

In the Bala the brim undergoes some modification in that the radial grooves extend to the genal angles, eliminating the small V-shaped furrows. *Trinucleus hibernicus* and *T. albidus* are the representatives of this group.

Returning to the Arenig for the ancestors of this line, the *etheridgi-murchisoni* group, with their deeply furrowed brim, seem the most likely. As I have said before, two or three furrows on the anterior part of the brim bifurcate, but it is easier to conceive of these becoming modified into straight ones, than that the descendants of *T. gibbsi* and *T. sedgwicki* should develop deep furrows, once having lost them.

Raymond's three genera, *Cryptolithus*, *Trinucleus*, and *Tretaspis*,

have thus come down in three fairly distinct lines of descent. There are two side branches that do not fit well in any one of these groups, and for one of them at least it is necessary to make a new genus. For this first group I propose the name of *Botrioides* and include in it *Trinucleus coscinorrhinus* of the Llandeilo as the type, and *T. bucculentes* and *T. foveolatus* (Plate, fig. 10-12) of the Bala. All these are Scandinavian forms. *Trinucleus coscinorrhinus* is from Sweden, the other two from Norway. This group combines the characteristics of *Trinucleus* and *Tretaspis*. It differs from the former to which it is most closely allied, by the presence of lateral ocelli and a median pustule, and from the latter, by the extreme narrowness of the brim which carries either a single row of large pits, or short radial furrows. One of the most distinctive characteristics is the exaggerated appearance of the glabella, which is round and bulbous, and overhangs the brim at the anterior end. The neck of the glabella is narrow and constricted, as in *Tretaspis seticornis*, and is marked by strong furrows. It is not easy to see how this genus can be derived from any of the known Arenig forms, and therefore it must be referred back to the hypothetical common ancestor in the Upper Cambrian. *Botrioides coscinorrhinus* and *B. foveolatus* are more nearly like this ancestor than are any of the other described species, including those from the Arenig, and therefore they must be regarded as the culmination of an early offshoot from the common stock. It is possible that *Trinucleus hibernicus* also belongs in this group. From an examination of specimens in the Sedgewick Museum, Cambridge, it appears that the brim is fairly narrow, with three pits at the bottoms of the radial furrows, the glabella is flask-shaped and furrowed. Eye-spots and a median pustule are present, and one well-preserved specimen carries the so-called "eye-line." These genal caeca, in this, and in other members of the family, are not eye-lines, as Raymond (39, p. 84, fig. 25) has shown.

Tretaspis carinata and *T. latilimba* (Plate, fig. 8) from Sweden have the generic characteristics of Raymond's classification. The brim, however, differs from the type (*i.e.*, *T. seticornis*). It is wide, bearing four or five concentric rows of large pits, but there is no differentiation into an outer and inner border. Whether they should be placed in another genus is a matter of opinion.

No mention has yet been made of the Arenig species from the Montagnes Noires called by Born *Trinucleus primitivus*. Under Raymond's division of genera, this would be a *Cryptolithus*, but it is so unlike any other *Cryptolithus*, and the evidence concerning it so scanty, that I have not been able to place it. According to Born the

brim is dotted with numerous small pits, which are absolutely irregular in their arrangement. No *Cryptolithus* yet known has the pits scattered in this fashion, since they follow neither a radial nor a concentric pattern. There are no glabellar furrows or eye-spots. As to *Trinucleus pracedens* Kloucek, from Bohemia, owing to the brevity of the description it is impossible to state in which genus it belongs, or what its place would be in the line of evolution.

Professor Raymond (38, p. 204) has considered *Trinucleus reussi* Barrande the oldest and most primitive member of the family, and has made for it a new genus, *Trinucleoides*. It does not seem to me that this species belongs in the family at all, and therefore I have omitted it. From an examination of specimens in the M. C. Z., it becomes apparent that the species bears a much closer resemblance to *Dionide*, notably *D. speciosa* Corda, and *D. formosa* Barr. The brim of *Trinucleoides reussi* is narrow, and bears two concentric rows of very small pits, there being no trace of radial arrangement. We have the same type of brim in *Dionide*, with the addition of one or two rows of pits. Furthermore, the lateral lobes of the glabella are well defined, and are of the same shape, and in the same position, as in *Dionide*.

GEOGRAPHICAL DISTRIBUTION OF SPECIES.

The Arenig contains five species of *Trinucleus*, four in Great Britain and one in Bohemia. I have not included the possible *Cryptolithus* in France. Neither have I included *Trinucleoides reussi*. Both these species have been diseussed (p. 97). Bohemia has usually been considered the center of origin and distribution of this family, but it soon becomes apparent that Great Britain is the more important source, which position it holds throughout the Ordovician.

The Llandeilo contains four species of *Trinucleus*, two in England, and two in the United States; seven *Cryptolithi*, three in Great Britain, four in France and Bohemia. *Tretaspis* appears for the first time, once in Scotland, and once in the United States. There also occur in Scandinavia two species, *Trinucleus coscinorrhinus*, and *T. efflorescens* for which I have made the genus *Botrioides*.

The Bala is the period in which *Cryptolithus* became dominant. There are fourteen distinct species in all, six in the British Isles, five in Bohemia, France, and Portugal, one in Norway, and two in the United States. There are two species of *Trinucleus*, one in Ireland, and one in Scotland, and five *Tretaspi*, one in Wales, one in Ireland, one in Norway, and two in Sweden. The *Cryptolithi* of Portugal are

the same as those of France, and the Bohemian species also occur in France. The distribution of *C. goldfussi* is widespread, occurring in all three countries, Bohemia, France, and Portugal. In the United States, *Cryptolithus*, although only represented by two species, has a remarkable distribution, occurring at many places from Quebec, up the St. Lawrence Valley, through New York, Pennsylvania, and Virginia, and ending with Oklahoma.

The Ashgillian sees the dominance of *Tretaspis*, the wane of *Cryptolithus* and the extinction of *Trinucleus*. It is particularly characterized by the remarkable spread of *Tretaspis seticornis* or its variety, *T. bucklandi*, which occurs in England, Scotland, Ireland, France, Bohemia, Esthonia, Denmark, Norway, and Sweden. Besides this, five other species of *Tretaspis* occur in the Scandinavian region. Two *Cryptolithi* occur in Ireland, one in Spain, three in Bohemia, and one in the United States.

It should be noted that the remarkable spread of *Cryptolithus tessellatus* in North America finds its parallel in the wide distribution of *Tretaspis seticornis* in the Ashgillian of Europe. Except for these two instances, the distribution of the family has been along the lines of great variety of species each with a small geographical range. Variety of species should indicate diverse environmental conditions. Wide distribution of the same species should indicate uniform environment over a wide area. On this basis the Trenton seas of eastern North America, and the Ashgillian seas of Europe, were probably shallow and open, having uniform environmental conditions. The seas of the other periods were probably deeply embayed, each estuary having its own particular conditions of temperature, salinity, and sedimentation, controlled in part by localized currents, and in part by the position and size of the rivers entering each estuary. In such a sea the animals would respond to the particular conditions in which they happen to find themselves, resulting in a great variety of species.

The apparently sporadic occurrences of trinucleids in Bolivia, *Trinucleus boliviensis* Lake, and *Cryptolithus kruegeri* (Hoek), and in China, *Tretaspis richthofeni* (Kayser), are cases of unexplained distribution. Doubtless with further field-work, more species would be uncovered.

From the foregoing, it is obvious that the British Isles stand out as a more important distributing center than the Bohemian Basin. The French, Spanish, and Bohemian *Cryptolithi*, with one or two exceptions, are characterized by the same species, so a free interchange must be assumed for these areas during Bala time. On the other hand,

not a single one of these species finds its way to the British Isles, nor does a British species appear on the continent. Furthermore, until the Ashgillian, not a single *Tretaspis*, and only one *Trinucleus*, is known from France, Spain, or Bohemia. *Tretaspis* is preëminently a northern genus, attaining its dominance in Scandinavia. One species, *T. seticornis*, became (p. 99) very widespread, which must indicate a free interchange between the epicontinental seas of the late Ordovician. It is also interesting to note that no species of *Cryptolithus* has yet been found in Scotland, and only one in Norway. This appears to be almost exclusively a southern genus.

Neither *Trinucleus* nor *Tretaspis* was significant in the United States, the former being restricted to two species, each with a single occurrence in the Normanskill, and the latter to one species and one occurrence. The extraordinary spread of *Cryptolithus* in the United States during the Trenton, is not easily explained. Furthermore its distribution is confined to a relatively narrow northeast-southwest band along the eastern side of the present continent. There seems to have been little penetration of the interior seas. It may be that unfavorable temperature conditions prevented the spread of the *Trinucleidae* into these shallow seas. That the water was warm is indicated by the presence of such corals as *Columnaria*, and *Tetradium*. In this connection it is interesting to note that in the Hull formation of Ontario, the equivalent of the Glens Falls formation of New York, (Raymond 40, p. 585), there are found *Columnaria* and *Tetradium* but no *Trinucleidae*, although the latter are abundant in the Glens Falls. In the Logana of Central Kentucky, these corals and some *Cryptolithi* do occur together, but the latter are very scarce, showing that they could make little headway to the westward, into these warmer seas.

The migration route of the family into North America is a question very difficult to solve at present. Raymond (39, p. 101) has shown that their physical form is that of a bottom habitus. The broad head shield may have served as a snowshoe-like contrivance, preventing the animal from sinking in the mud. Not being swimmers, they must have inhabited shallow seas, except in their younger free swimming or floating stages. If the shallow border of the Arctic Ocean was the route of migration, it seems strange that *Cryptolithus* occurs only once in Scandinavia and not at all in Scotland. In addition, there is but a single species with one occurrence, in the United States, of *Tretaspis*, that typically northern genus. Schuchert found none of the *Trinucleidae* in the Ordovician of Baffinland. Dr. Gustave Troedsson, in a recent letter to Professor Raymond, states that he found none in the

Ordovician material that Dr. Koch has recently brought back from northern Greenland. Similarly no Trinucleidae have been found in the now rather well-known faunas of Llandeilo age from Newfoundland, and so far, Trenton faunas have not been found on that island. All the evidence, therefore, seems to be against the Arctic as a route of migration for members of this family.

Distribution of the protaspi by currents in the northern Atlantic seems, at present, to be the only plausible theory as to their spread. The courses of the currents that swept them into the interior sea, behind Appalachia, are, of course, impossible to trace. Shallow seas must have existed somewhere along the route to provide breeding grounds for the successive generations. What the intermediate stopping places were, between Europe and America is, for the present, unknown.

In conclusion I will briefly summarize the most salient facts of the distribution of this family:—first, the British Isles, and not the Bohemian Basin, as is commonly thought, stands out as the more important center of origin; second, *Tretaspis* appears to be almost exclusively a northern and *Cryptolithus* a southern form, and lastly, the weight of evidence is against the Arctic seas as a route of migration of the family into North America.

BIBLIOGRAPHY.

1. ANGELIN, N. P. [Palaeontologia Scandinavica. Holmiae. 1851, 1854].
2. BARRANDE, JOACHIM. Système Silurien du centre de la Bohême. 1852, **1**.
3. Système Silurien du centre de la Bohême. Supplement. 1872, **1**.
4. BARROIS, CHARLES. Mémoire sur la distribution des graptolites en France. Ann. Soc. géol. du Nord, 1892, **20**, p. 75–191.
5. BEECHER, C. E. Structure and appendages of Trinucleus. Amer. journ. sci., 1895, ser. 3, **49**, p. 307–311, pl. 3.
6. BERGERON, JULES. Description de quelques trilobites de l'Ordovicien d'Ecalgrain. Bull. Soc. géol. Normandie, 1894, **15**.
7. BORN, AXEL. Eine Untersilurfauna aus den montagnes noires. Senckenbergiana, 1921, **3**, p. 181–193.
8. BRÖGGER, W. C. Über die verbreitung der Euloma-Niobe fauna (der Ceratopygenkalkfauna) in Europa. Nyt. mag. natur., 1897, 1898, **36**, p. 164–240.
9. DELGADO, J. F. N. Fauna Silurica de Portugal. Direc. Trabal. geol. Portugal, 1897, 34 pp., 4 pls.
10. FEARNSIDES, W. G., ELLES, G. L., and SMITH B. Lower Palaeozoic rocks of Pomeroy. Proc. Roy. Irish acad., 1907, **26**, sec. B, no. 9, p. 97–128.

11. FRECH, FRITZ. *Lethaea geognostica*. Theil 1. *Lethaea Palaeozoica*.
12. GEIKIE, ARCHIBALD. *Textbook of geology*. Ed. 4. 2 vols. London and New York. 1903.
13. GREEN, JACOB. Synopsis of the trilobites of North America. *Month. Amer. journ. geol. and nat. sci.*, 1832, **1**, p. 558-560.
14. HADDING, ASSAR. Undre Dicellograptusskiffern i Skåne jämte några därmed ekvivalenta bildningar. *Lunds univ. årsskrift*, 1913, n.f., afd. 2, **9**, nr. 15, 90, [3] pp., 8 pls.
15. HAUG, ÉMILE. *Traité de géologie*. Paris, 1921.
16. HICKS, HENRY. On the succession of the ancient rocks in the vicinity of St. David's * * * *Quart. journ. Geol. soc. London*, 1875, **31**, p. 167-195, pl. 8-11.
17. HOEK, H. [Versteinerungen des Cambriums und Silurs]. *Neues jahrb. beil. bd.*, 1912, **34**, p. 209-250, pl. 7-11.
18. HOLTEDAHN, OLAF. Studien über die etage 4 des Norwegischen Silur-systems beim Mjösen. *Vidensk.-selsk. skrifter, Math. natur. klasse*, 1909, **1**, no. 7, 76 pp.
19. HOLUB, KARL. Über eine neue fauna des Untersilurs in der umgebung von Rokycan. *Bull. intern. Acad. sci. Bohême*, 1911.
20. KAYSER, EMANUEL. Mittel- und Obersilurische versteinerungen aus dem Gebirgsland von Tschau-Tien. *Richthofen's China*, 1883, **4**.
21. KERFORNE, F. Note sur l'Ordovician du May-sur-Orne (Calvados). *Bull. Soc. sci. med. de l'Ouest*, 1893, **2**, p. 112-116.
22. KLOUCEK, CELDA. Über die D₁γ schichten und ihre trilobitenfauna. *Bull. intern. Acad. sci. Bohême*, 1916, p. 1-16.
23. LAKE, PHILIP. Trilobites from Bolivia collected by Dr. J. W. Evans in 1901-1902. *Quart. journ. Geol. soc. London*, 1906, **42**, p. 425-430, pl. 40.
24. LINNARSSON, J. G. O. Om vestergötlands Cambriska och Siluriska aflageringar. *Kongl. Svensk. vet. akad. Handl.*, 1869, **8**, no. 2, 89 pp., 2 pls.
25. MCCOY, FREDERICK. A synopsis of the Silurian fossils of Ireland. Dublin. 1846.
26. On the classification of some British fossil Crustacea. *Ann. mag. nat. hist.*, 1849, ser. 2, **4**, p. 161-179, 330-335, 392-414.
27. A synopsis of the classification of British Palaeozoic rocks. Cambridge. 1855.
28. MURCHISON, R. I. *The Silurian system*. London. 1839.
29. NICHOLSON, H. A., and ETHERIDGE, ROBERT, JR. A monograph of the Silurian fossils of the Girvan district in Ayrshire. Edinburgh and London. 1878-1880.
30. OEHLERT, D. P. Sur les Trinucleus de l'Ouest de la France. *Bull. Soc. géol. France*, 1895, sér. 3, **23**, p. 299-336, pl. 1, 2.
31. OLIN, E. Om de Chasmopskalken och Trinucleusskiffern motsvarande bildningarne i Skåne. *Lunds univ. årsskrift*, 1906, n.f., afd. 2, **2**, nr. 3, 79, [2] pp., 4 pls.

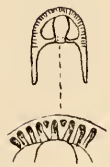
32. POÛTA, PHILIPPE. Parallèle entre les dépôts Siluriens de la Bretagne et de la Bohême. Bull. Soc. d'études sci. d'Angers, 1895, p. 137-146.
33. PORTLOCK, J. E. Report on the geology of the county of Londonderry, and of parts of Tyrone and Fermanagh. Geol. surv. Gt. Brit. and Ireland. Dublin. 1843.
34. RAVN, J. P. J. Trilobitfaunaen i den bornholmske Trinucleuskefer. Danmark geolog. undersog. 1899, **2**, no. 10, p. 49-62.
35. RAYMOND, P. E. A further note on *Cryptolithus* versus *Trinucleus*. Ottawa nat., 1913, **27**, p. 26-30.
36. Trilobita. Text-Book of palaeontology. Ed. 2. London. 1913, **1**.
37. Expedition to the Baltic provinces of Russia and Scandinavia. Part 1. The correlation of the Ordovician strata of the Baltic basin with those of eastern North America. Bull. M. C. Z., 1916, **56**, p. 177-286, pl. 1-8.
38. Beecher's classification of trilobites after twenty years. Amer. journ. sci., 1917, ser. 4, **43**, p. 196-210.
39. The appendages, anatomy, and relationships of trilobites. Mém. Conn. acad., 1920, **7**, p. 1-169.
40. Trenton of central Tennessee and Kentucky. Bull. Geol. soc. Amer., 1922, **33**, p. 571-586.
41. Some trilobites of the Lower Middle Ordovician of eastern North America. Bull. M. C. Z., 1925, **67**, p. 1-180, pl. 1-10.
42. REED, F. R. C. New trilobites from the Bala beds of Co. Waterford. Geol. mag., 1895, new ser. dec. 4, **2**, p. 49-55, pl. 55.
43. *Trinucleus seticornis*. Geol. mag., 1897, new ser. dec. 4, **4**, p. 427-428.
44. The Lower Palaeozoic trilobites of the Girvan district, Ayrshire. Palaeontogr. soc., 1903, p. 1-48, pl. 1-6.
45. New fossils from the Dufton shales. Geol. mag., 1910, new ser. dec. 5, **7**, p. 211-220, pl. 17.
46. Lower Palaeozoic trilobites of Girvan. Supplement. Palaeontogr. soc., 1914.
47. Notes on the genus *Trinucleus*. Part 1. Geol. mag., 1912, new ser. dec. 5, **9**, p. 346-353, pl. 18. Part 2. p. 385-394, pl. 19. Part 3. 1914, new ser. dec. 6, **1**, p. 349-353, pl. 18, 19. Part 4. 1916, new ser. dec. 6, **3**, p. 118-123, 169-176.
48. ROUAULT, MARIE. Extrait du mémoire sur les trilobites du département d'Ille-et-Vilaine. Bull. Soc. géol. France, 1847, sér. 2, **4**, p. 309-319, 325-328, pl. 3.
49. RUEDEMANN, RUDOLF. Trenton conglomerate of Rysedorph Hill, Rensselaer co. N. Y. and its fauna. Bull. 49, N. Y. state mus., 1901, p. 3-114, pl. a, b, 1-7.
50. The Utica and Lorraine formations of New York. Pt. 1. Bull. 258, N. Y. state mus., 1925, 175 pp., 7 pls.
51. SALTER, J. W. Notes on the trilobites. Quart. journ. Geol. soc. London, 1853, **9**, p. 158-160, pl. 7.

52. SALTER, J. W. Figures and descriptions illustrative of British organic remains. Dec. 7. Mem. Geol. surv. Gt. Britain and Ireland. London. 1853.
53. [Fossils from North Wales]. Mem. Geol. surv. Great Britain, 1866, **3**, p. 239-363, 372-381, pl. 1-26.
54. A catalogue of the Cambrian and Silurian fossils in the geological museum of the University of Cambridge. Cambridge. 1873.
55. SCHMIDT, FRIEDRICH. Revision der Ostbaltischen Silurischen trilobiten. Mem. Acad. imp. sci. St. Petersburg, 1907, **20**, no. 8, 104 pp., 3 pls.
56. SWINNERTON, H. H. Suggestions for a revised classification of trilobites. Geol. mag., 1915, dec. 6, **2**, p. 487-496, 538-545.
57. The facial suture of trilobites. Geol. mag., 1919, dec. 6, **6**, p. 103-110.
58. TROEDSSON, G. T. Om Skånes brachiopodskiffer. Lunds univ. årsskrift, 1918, n.f. afd. 2, **15**, nr. 3, 110 pp., 2 pls.
59. TROMELIN, GASTON DE et LEBESCONTE, PAUL. Observations sur les terrains primaires du nord du département d'Ille-et-Vilaine et de quelques autres parties du massif Breton. Bull. Soc. géol. France, 1876, ser. 3, **4**, p. 583-623.
60. ULRICH, E. O. Descriptions of some new species of fossils, from the Cincinnati group. Journ. Cine. soc. nat. hist., 1878, **1**, p. 92-100, pl. 4.
61. Ordovician "hypoparian" genera of trilobites. (Abstract). Bull. Geol. soc. Amer., 1922, **33**, p. 205-206.
62. VERNEUIL, EDOUARD DE et BARRANDE, JOACHIM. Description des fossiles trouvés dans les terrains Silurien et Dévonien d'Almaden, d'une partie de la Sierra Morena et des montagnes de Tolède. Bull. Soc. géol. France, 1855, ser. 2, **12**, p. 964-1025, pl. 23-29.
63. WADE, ARTHUR. The Llandovery and associated rocks of north-eastern Montgomeryshire. Quart. journ. Geol. soc. London, 1911, **67**, p. 415-459, pl. 33-36.
64. ZELIZKO, J. V. Geologisch-palaeontologische verhältnisse der nächsten umgebung von Rozmitál in Böhmen. Bull. intern. Acad. sci. Bohème, 1906, **11**, 14 pp., 2 pls.

EXPLANATION OF PLATE.

PLATE.

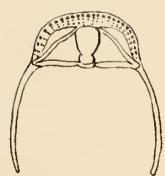
- Fig. 1. *Trinucleus murchisoni* Salter (From Salter). Shropshire and Wales. The bifurcating furrows are not clearly shown.
- Fig. 2. *Trinucleus sedgwicki* Salter (From Salter). Note the differentiation of the rows of pits of the brim.
- Fig. 3. *Trinucleus gibbsii* Salter (From Salter). Wales. The diagonal "eyelines" are not present on the specimen.
- Fig. 4. *Trinucleus efflorescens* (Hadding) (From Hadding). Sweden. Note the tendency towards a second row of pits and the concentric type of brim. A *Trinucleus* approaching the *Cryptolithus* type.
- Fig. 5. *Trinucleus fimbriatus* Murchison (From Reed). Wales. The radiating rows of pits are really at the bottom of shallow furrows.
- Fig. 6. *Tretaspis bucklandi* (Barrande) (From Olin). Note the differentiation of the pits of the brim into inner and outer rows. Eye-spots probably were present.
- Fig. 7. *Tretaspis reticulata* Ruedemann (From Ruedemann). Rysedorph Hill, New York. An American type of *Tretaspis*. The inner rows of pits are more nearly the size of the outer than in most of the European forms.
- Fig. 8. *Tretaspis latilimba* (Linnarsson) (From Linnarsson). Scania. A European *Tretaspis* resembling strongly the American.
- Fig. 9. *Trinucleus diademata* (Ruedemann) (From Ruedemann). Rysedorph Hill, New York. An American type of *Trinucleus*. The radiating furrows of the brim are more strongly marked than in *T. fimbriatus*.
- Fig. 10. *Botrioides foveolatus* (Angelin) (From Angelin). Near Oslo. Note the simple, narrow brim. A very primitive form.
- Fig. 11. *Botrioides bucculentes* (Angelin) (From Angelin). Near Oslo. Figure somewhat distorted. Note the bulbous, bottle-necked glabella with deep furrows and the narrow brim.
- Fig. 12. *Botrioides coscinorrhinus* (Angelin) (From Hadding). Southern Sweden. Note the simple, narrow brim. A very primitive form.



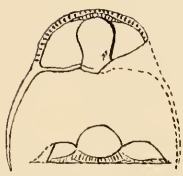
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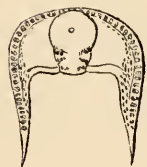
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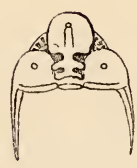
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AT HARVARD COLLEGE.

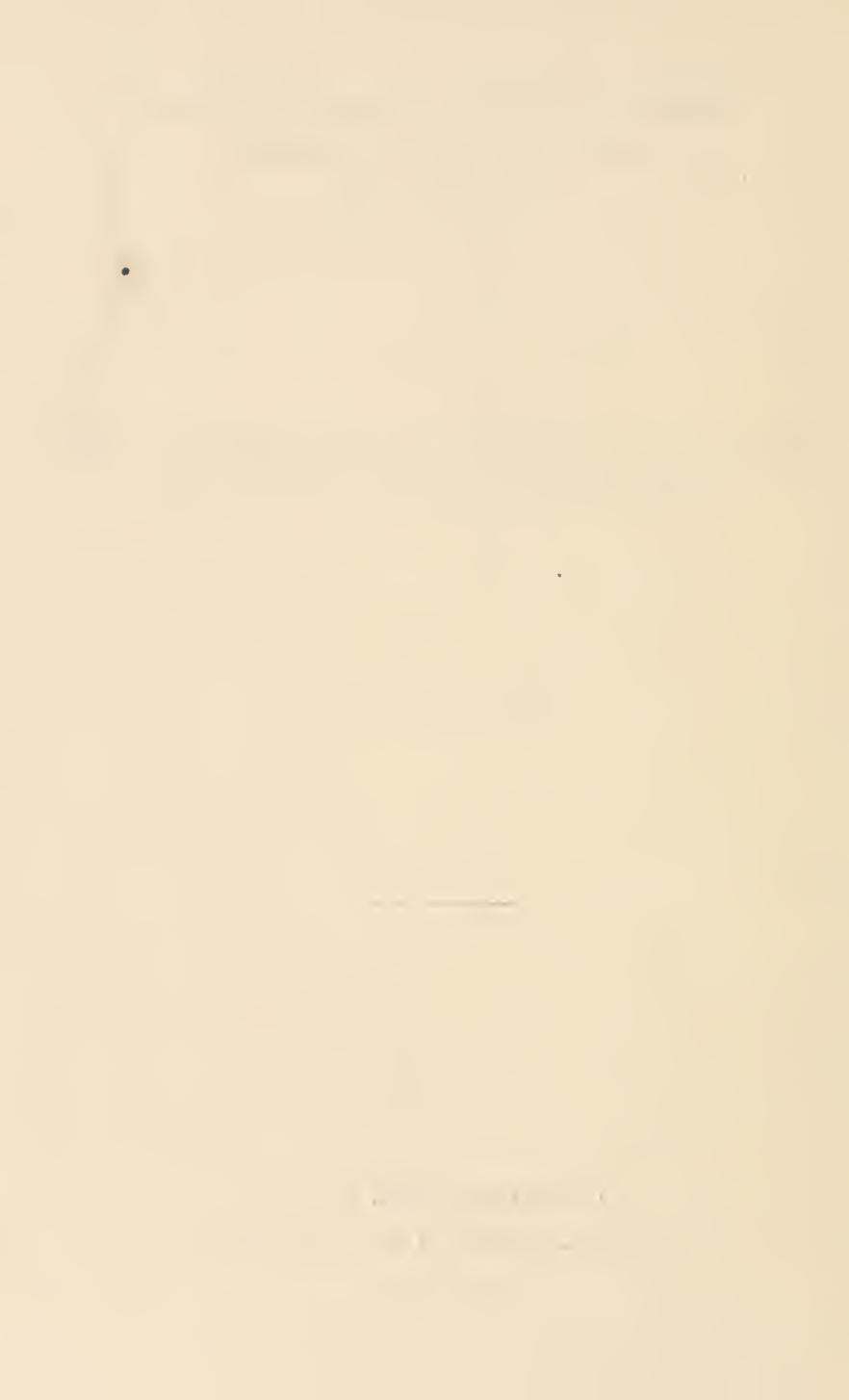
VOL. LXVIII. No. 3.

DESCRIPTIONS OF NEW SOUTH AMERICAN FRESH-WATER
FISHES COLLECTED BY DR. CARL TERNETZ.

BY GEORGE S. MYERS.

CAMBRIDGE, MASS., U. S. A.:
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JULY, 1927.



No. 3.— *Descriptions of New South American Fresh-Water Fishes*
collected by Dr. Carl Ternetz.¹

BY GEORGE S. MYERS.

THE present report is concerned with the description of some new species obtained for Indiana University by Dr. Carl Ternetz in the Rio Tocantins and its headwaters, the Lower Amazon as far as the mouth of the Rio Negro, the Rio Negro to the entrance of the Cassiquiare, the Cassiquiare, and the Orinoco from Bifurcation to Caicara. Dr. Ternetz started in the headwaters of the Tocantins in September, 1923, and ended his collecting at Caicara in May, 1925. The result is a magnificent series of fishes, most of them from waters hitherto unexplored systematically by an ichthyologist.

The collection is so vast that any attempt at an estimate of its richness is impossible. The forms treated are merely some of the smaller species noticed as being of especial interest. The percentage of novelties will undoubtedly be greatly augmented when the bulk of the collection is examined, especially as practically all of the larger fishes are as yet unstudied. In the Pygidiidae only is the report at all complete.²

In the absence of Dr. Eigenmann from the University, he very kindly allowed me to describe some of the new species and authorized an agreement as to the publication of my results whereby a series of the new species was given to the M. C. Z.³

A remarkable new form is the *Gnathodolus bidens*, with mouthparts unique among fishes; scarcely less interesting are the finless pygidiid *Glanapteryx* and the crenuchine characin *Elachocharax*. A few species collected in Peru by Dr. W. R. Allen, in Bolivia by Dr. N. E. Pearson, and at Rio de Janeiro by Mr. R. Brocca are included.

In the descriptions I have taken the scale-counts from the upper end of the gill-opening to the approximate end of the hypural bone, this being designated as "caudal base," and from the base of the first dorsal ray to the pelvic fins.

¹ Contributions from the Zoölogical Laboratory of Indiana University, No. 217.

² Dr. E. W. Gudger has a paper in preparation on the parasitic Pygidiidae, partially based on the present collection.

³ Dr. Eigenmann died at Coronado, California, 24 April, 1927.

ANOSTOMATIDAE.

GNATHODOLUS, gen. nov.

γνάθος, jaw, and δόλος, a trap.

GENOTYPE.—*Gnathodolus bidens* Myers.

Anostomatinae. Form heavy, compressed. Snout deep, elliptical in cross-section, truncate. Mouth-opening vertical or even inclining somewhat backward, narrow and elongate. Lower jaw rod-like, folding upward to close the mouth-slit. The jaw extends up beyond the top of the snout in adult specimens, and bears at its tip two large, hooked, projecting teeth, sickle-shaped at the tip. The dentition of the upper jaw consists of three or four spear-shaped teeth on each side, directed outward and nearly imbedded in the flesh. Gill-membranes united, confluent with the isthmus. Lateral line complete.

GNATHODOLUS BIDENS, sp. nov.

Head $3\frac{1}{2}$ in body-length. Depth $3\frac{2}{5}$. Eye 4 in head, $1\frac{1}{2}$ in snout, 2 in interorbital. Dorsal $11\frac{1}{2}$. Anal $10\frac{1}{2}$. Scales 5–31–5, about 12 predorsal.

Eyes bulging, with a strong adipose lid, particularly anteriorly. The eyes project more anteriorly than posteriorly and thus point a little backward. The fish apparently cannot see forward. Margins of mouth-opening and of lower jaw thickly papillose. Dorsal originating an eye-diameter nearer to snout-tip than to caudal base. Pelvics inserted under third dorsal ray. Pectorals not to pelvics. Pelvics distant from anal. Adipose fin over posterior part of anal base. Caudal forked, asymmetrical, the upper lobe longer with the appearance of a piece having been bitten from its inner portion. Lower lobe shorter, thick, and rounded. This is the formation in the Type and as it is duplicated in the one Paratype (from a different locality) that has an unbroken caudal, it seems to be natural. There are, however, traces of some slight regeneration along the whole caudal edge in both specimens, but the agreement in caudal form of the two perfect specimens could hardly be a coincidence.

Scales large, hard, similar to those of *Leporinus friderici* Cockerell, (Ann. Carnegie mus., 1914, 9, pl. 26, fig. 3), but longer; little exposed, most of the exposed surface being formed by a wide soft apical border; both soft and hard apical margins evenly rounded; a few nuclear polygonal areas giving rise to five or six apical radii, two upper and two

lower antipodal radii, and three or four basal radii. Basal notch as in *Leporinus*. Circuli faint, becoming obsolete or absent on the exposed sector of the scale.

Coloration dull brownish. Midpredorsal area blackish. Six to eight diffuse dark cross-bars from midline of back, becoming indistinct and fading before reaching the lateral line. A large diffuse black spot on middle of sides below posterior part of dorsal base and a similar smaller one opposite the anal. Scales with indistinct light basal areas, these forming faint lateral stripes. Suborbital area tinged with violet.

TYPE.—17,670 I. U. 134 mm. Venezuela: Rio Cassiquiare, Chemoni (near Bifurcation). 13 March, 1925. Carl Ternetz.

PARATYPES.—17,671 I. U. 31,566 M. C. Z. 90,103 mm. Venezuela: Lago Tama-Tama, Bifurcation. 24 March, 1925. Carl Ternetz.

CURIMATIDAE.

CURIMATUS MULTILINEATUS, sp. nov.

Head $3\frac{2}{3}$ in body-length. Depth $3\frac{1}{3}$. Eye $2\frac{2}{3}$ in head, equal to inter-orbital, a little longer than snout. Least depth of caudal peduncle $2\frac{1}{4}$ in head. Dorsal 11. Anal $9\frac{1}{2}$. Scales 4–31– $4\frac{1}{2}$.

Ventral profile slightly more arched than the dorsal. Dorsal profile somewhat arched on head, with a slight break in the symmetry at nape. Greatest depth at dorsal origin.

Dorsal fin originating an eye-diameter nearer to snout-tip than to caudal base. Pelvics originating under middle of dorsal base. Pectorals not nearly reaching pelvics. Pelvics not nearly to anal. Adipose large, over posterior part of anal base. Anal rays not reaching caudal. Depressed dorsal rays not reaching vertical of anal fin-origin.

A dark line from under jaw around snout to eye. Narrow dark brown longitudinal lines between the scale-rows. Iris dark interiorly, light exteriorly. Fins slightly dusky.

TYPE.—17,672 I. U. 55 mm. Brazil: Rio Negro, Bucury. 7 February, 1925. Carl Ternetz.

Bucury is evidently above São Gabriel, since Dr. Ternetz collected at that place on February 1, on his way up-river.

Differs from all known species in its striking coloration. Perhaps nearest *C. microcephalus*.

HEMIODONTIDAE.

HEMIODUS TERNETZI, sp. nov.

Head $4\frac{2}{5}$ to $4\frac{2}{3}$ in body-length. Depth $4\frac{2}{5}$. Eye 3 in head. Scales 11-63-6. Dorsal 9. Anal 9.

Dorsal fin-origin slightly more than a snout-length nearer to snout-tip than to caudal base. Pelvics inserted under the fifth dorsal ray. Pectorals nearly their own length short of reaching pelvics.

Brown on back, the scales basally dark with a light border. Sides silvery. A conspicuous dark lateral band from eye to caudal base, expanded into a spot above the pectoral tips and again above the last half of the appressed pelvics. Lower caudal lobe dark, the upper light, the darker lateral band turning downward at caudal base and running out through the middle of the lower lobe.

TYPE.—17,691 I. U. 100 mm. Brazil: Jausinho Brook, into the Tocantins, Goyaz. 22 February, 1924. Carl Ternetz.

PARATYPES.—17,692 I. U. 31,567 M. C. Z. 85-88 mm. Brazil: Jausinho Brook, into the Tocantins, Goyaz. 22 February, 1924. Carl Ternetz.

Named for Dr. Carl Ternetz, who, through his personal effort, has brought together for Indiana University one of the finest collections of South American fresh-water fishes in existence.

CHARACIDAE.

COPEINA COMPTA, sp. nov.

Head $4\frac{1}{2}$ to $4\frac{2}{3}$ in body-length. Depth $5\frac{1}{2}$. Scales 26 to caudal base, 16 rows around body before pelvics, 17 predorsal. Eye equal to snout, $3\frac{1}{3}$ in head. Dorsal 10. Anal 11.

Dorsal originating $1\frac{1}{2}$ times as far from head as from caudal base. Anal inserted under about the fourth dorsal ray. In the adult male the fins are greatly prolonged; the produced middle rays of the dorsal reach the caudal; the pelvic rays reach the end of the anal base; the elongate pointed upper caudal lobe is $1\frac{2}{3}$ times as long as the head. The male pectorals are longer, but in neither sex do they reach the pelvics. The caudal base as well as the caudal shows a heterocercal tendency.

Coloration dark. A dark band around the chin through the eye and across the opercle, becoming diffuse posteriorly. Back brownish. A

wide dark lateral band down the side, its upper edge well defined and continuous with the head-streak, its lower border fading gradually into the dull yellow of the venter. On the middle of the second to the sixth dorsal rays there is a black blotch, above a basal whitish one. The elongate dorsal and caudal rays of the male are slightly black tipped.

TYPE.—17,693 I. U. ♂ 71 mm. Brazil: Creek above São Gabriel Rapids, Rio Negro. January, 1925. Carl Ternetz.

PARATYPES.—17,694 I. U. 31,568 M. C. Z. ♂ ♀ juv. 65–71 mm. Brazil: Creek above São Gabriel Rapids, Rio Negro. 28–30 January, 1925. Carl Ternetz.

This species represents the acme of gracefulness reached by characins of the Pyrrhulininae. I have compared it with a single male *C. arnoldi* from the lower Amazon, received from Mr. Arthur Rachow of Hamburg, and with many specimens of *C. callolepis* collected by Dr. Ternetz at various localities on the Lower Amazon. The latter is the only closely-related species. *Copeina arnoldi* is much deeper, and both differ from *C. compta* in the scale-count, fin-positions, and coloration; *C. carsevernnensis* differs much in the fin-positions.

I take this opportunity to point out the similarity of *Pyrrhulina obermülleri* Myers (Copeia, 1926, no. 156, p. 150. Iquitos) to *P. lugubris* Eigenmann (Mem. Carnegie mus., 1922, 9, p. 231, pl. 21, fig. 1. Meta Basin), with which by an oversight I neglected to compare it. The former will probably rank as a brilliantly-colored subspecies of the latter. Both are well distinguished from *P. brevis* by the narrow elongate and almost straight strongly-toothed maxillary. In *P. brevis* it is short and curved.

The shape of the maxillary is important in the distinction of the species of Pyrrhulininae. In *Copeina argyrops* and *C. guttata* it is short, almost round, and toothless. In *Copeina callolepis* and *C. compta* the maxillary of the male is of a peculiar shape, having a triple curve, and it is toothed. In *C. arnoldi* and *C. metae* it is toothed, somewhat elongate, and a little curved, like that of *Pyrrhulina brevis*. That of Guiana specimens of *P. semifasciata* is similar, but in Guiana *P. filamentosa* the maxillary is toothless, although similar in shape. The maxillary of *P. rachoviana*, due to the short heavy head, is nearly vertical; it is toothless.

Pyrrhulina rachoviana Myers (Blätt. aquar. terrar., 1926, 37, p. 441) is very similar to Steindachner's figure of the male of his *P. brevis* (Sitzb. K. akad. wiss., Wien, 1875, 72, pl. 1, fig. 3), but *P. rachoviana* has a shorter head and the pectorals do not reach the pelvics, the latter being larger in *P. brevis*. The dorsal spot of *P. rachoviana* is more

streak-like, and is confined to the anterior rays. I hereby restrict the name *P. brevis* to Steindachner's "female" (*loc. cit.*, fig. 4) which is probably specifically different from the "male." I do not know the form Regan had (*Ann. mag. nat. hist.*, 1912, ser. 8, **10**, p. 392).

ATOPOMESUS, gen. nov.

ἄτοπος, peculiar, and μέσος, middle.

GENOTYPE.—*Atopomesus pachyodus* Myers.

Cheirodontinae. Teeth extremely massive and heavy, somewhat laterally compressed, but the major ones arising to an unexpanded, rounded crest which is compressed anteroposteriorly, this forming a rather blunt, rounded, transverse, cutting crown without any cusps or notches whatever. The three front-teeth on each side of the dentary are especially massive, each with an inner, oblique flat area. They grade downward in size toward the sides, the fifth to the eighth tooth of each side of the dentary with a falcate inner crown rather than a flat surface, this being formed by a single inner cusp. Following these at the side are two abruptly smaller conical teeth. Premaxillary teeth in a single series, seven on each side, grading from the central massive ones to smaller ones at the side, all directed obliquely backward, the tips and extreme inner bases of the teeth tinged with brown. Maxillary with six small conical or slightly notched teeth crowded to its upper end.

Mouth inferior, the lower teeth fitting up inside the retrorse upper ones. The flat areas of the mandibular dentition cannot, then, be grinding surfaces. The upper teeth are slightly visible from below when the mouth is closed, but are in no way exposed like those of *Henochilus* and *Psolidodon*, with which I at first thought this genus was related.

A series of large scales on each side of the preentral region overlapping at the midline, as in *Phenacogaster*. Accessory caudal rays prominent.

ATOPOMESUS PACHYODUS, sp. nov.

General appearance of a slender *Creagrutus* or *Phenacogaster*.

Head $3\frac{2}{3}$ in body-length. Depth 4. Dorsal 10. Anal 22. Scales 4-32-3, predorsal 9, fully scaled. Eye $2\frac{2}{3}$ in head, much greater than interorbital, the orbit horizontally oval.

Dorsal origin half an orbit-diameter nearer to snout-tip than to caudal base, the fin high and pointed. Anal origin under last few dorsal rays, its margin falcate, the anterior few rays long. Pelvics originating

very slightly in advance of vertical of dorsal origin, a little overlapping the anal fin-origin. Pectorals reaching pelvics. Adipose well developed, over posterior anal rays. Scales cycloid, lateral line complete. Caudal naked, the lobes pointed, the upper slightly the longer. Accessory caudal rays well developed, the upper ones especially prominent.

Great suborbital leaving a wide naked area below and a narrow one behind. Postorbitals two, the upper narrow and elongate.

Pale yellowish, a silvery lateral streak. Scales of the back dark edged. Chromatophores gathered into the lateral streak posteriorly, many at the caudal base, but no distinct caudal spot.

TYPE.—17,673 I. U. 43 mm. Brazil: Cucuhy, Rio Negro, on the Colombian Border. 14 February, 1925. Carl Ternetz.

Unique in the massive retrorse dentition.

OTHONOCHEIRODUS, gen. nov.

ὄθωνη a napkin or veil, χερ, hand, and ὀδών, tooth, i.e. the veiled hand-shaped teeth.

GENOTYPE.—*Othonocheiroidus eigenmanni* Myers.

Cheirodontinae. Closely allied to *Monotocheiroidon*. Both these genera differ trenchantly from *Holoshesthes*, *Odontostilbe*, and *Cheirodon* in the severely horizontal gape and the uncovered and lipless teeth of the upper jaw. In the others the gape is oblique and the premaxillary teeth are hidden wholly or partially by the normal upper lip.

To the definition of *Monotocheiroidon* should be added the following characters:—gape horizontal; teeth of both the upper and lower jaws uncovered, lipless.¹ Horizontal extent of the maxillary great, with six or seven teeth; its vertical extent, at the curve, small, scarcely extending down below the line of the base of the mandibular teeth, its end not rounded or free. Caudal lobes unequal, the upper longer.¹

Othonocheiroidus may be described as follows:—adipose present; lateral line complete; predorsal area scaled; caudal naked; suborbital in contact with the preopercle below; caudal lobes equal; accessory caudal rays apparently normal. Teeth 5-pointed, similar in both jaws, contracted at the base, expanded at the tips. Gape horizontal, the horizontal extent of the maxillary small, with two teeth, its vertical extent long, extending far below the line of the bases of the mandibular teeth, its end large, rounded, and free. Premaxillary with four similar teeth on each side, in a single, not angulated series, continuous pos-

¹ These characteristics are not shown in Pearson's figure of *Monotocheiroidon pearsoni* Eigenmann, Indiana univ. studies, 1924 (1925), no. 64, pl. 11.

teriorly with the two maxillary teeth. Mandible with six similar 5-pointed teeth on each side, grading down slightly in size posteriorly. Upper jaw lipless. Under jaw with a thin deep lip which rises to cover not only the mandibular teeth but also part or all of the premaxillary teeth.

OTHONOCHEIRODUS EIGENMANNI, sp. nov.

Head $4\frac{1}{4}$ in body-length. Depth $3\frac{1}{4}$. Eye $3\frac{1}{3}$, a little less than inter-orbital, equal to snout. Scales mostly lost, apparently 4-34 to 36-3. Dorsal 9. Anal 14.

Body fairly deep, compressed, more so than in *Monotocheirodon*. Snout very blunt. Dorsal originating more than an orbit-diameter nearer to caudal base than to snout-tip. Anal inserted on vertical of end of dorsal base. Pectorals not reaching pelvics by three or four scales. Pelvics not quite to anal fin. Adipose inserted behind vertical of end of anal base.

Brownish; a conspicuous black humeral blotch; a dark lateral band, faint anteriorly, ending at caudal base.

TYPE.—17,674 I. U. 47 mm. Peru: Rio Cayumba. 1918. W. R. Allen.

PARATYPES.—17,675 I. U. 31,569 M. C. Z. 36-45 mm. Peru: Rio Cayumba. 1918. W. R. Allen.

Named for Dr. Carl H. Eigenmann, who has contributed more than anyone else to our knowledge of the fresh-water fishes of South America.

ELACHOCHARAX, gen. nov.

ἐλάχους, insignificant, and Charax, a genus of characins.

GENOTYPE.—*Elachocharax pulcher* Myers.

Crenuchinae. Mouth small, with scarcely any gape, the maxillary reaching vertical of anterior border of eye. Adipose present. Dorsal long, with 18 rays. Body not notably deep but much compressed, the head especially narrow and the snout pointed. Armature of the cheeks very weak. Frontal fontanel present.

Crenuchus has very wide jaws, a long gape, and an adipose fin. Poecilocharax, which has much narrower jaws than Crenuchus, still has a large gape and long maxillary, while it possesses no adipose. Poecilocharax is certainly not closely related to Crenuchus, and Elachocharax is even more divergent. The latter, and possibly Poecilocharax also, will eventually be removed from Crenuchus and placed near Characidium.

ELACHOCHARAX PULCHER, sp. nov.

Head equal to depth, $3\frac{1}{2}$ in length to caudal base. Dorsal 18. Anal 8. Lateral line incomplete, 5 or 6 scales with pores. Scales 25 lateral, 6 transverse between dorsal and pelvics.

The long pectorals reach the distant pelvics. Pelvics reach to anal fin. Predorsal and preventral areas rounded, normally scaled. Caudal not deeply forked.

Scales truncate basally, with many lateral striae (circuli) above and below, somewhat similar to those of *Poecilocharax*, but striae deeper and more evident. The scales of *Crenuchus* are similar in shape, but the striae are more inclined to be concentric than merely lateral above and below.

Coloration very dark. The scale-borders, where each row touches the row above and below it, are dark, forming zig-zag lines between the series. The body is crossed by eight diffuse wide dark bands, the first behind the pectoral axil, the last at the tail-root. The two in the anal region are extended out across that fin. The one at the tail-root has two small spots in it, which project out on the fin, the entire bar being followed by a colorless area. After this follow some faint caudal bands. The dorsal, whose margin is straight and the rays subequal, has two lengthwise lines near its base. The eye is crossed by two lines, one horizontal from the chin, another vertical from the occiput.

TYPE.—17,676 I. U. 21 mm. Venezuela: Caño de Quiribana, near Caicara. May, 1925. Carl Ternetz.

PARATYPE.—17,677 I. U. 22 mm. Venezuela: Caño de Quiribana, near Caicara. May, 1925. Carl Ternetz.

A pretty little species, suggestive of the North American *Elassoma*.

HYPHESSOBRYCON BALBUS, sp. nov.

Head $3\frac{3}{5}$ in body-length. Depth $2\frac{1}{2}$ (young) to $2\frac{1}{7}$ (adult). Dorsal 11. Anal 19 to 21. Scales 5–31 to 34–4 $\frac{1}{2}$. Lateral line stuttering, complete on a few specimens, usually developed on 12 to 20 scales.

Dorsal origin in middle of body-length, slightly behind vertical of origin of pelvics, which are reached by the pectorals. Pelvics reaching not quite to anal fin. Adipose over end of anal. Body deep and much compressed.

Cheeks entirely covered by the great suborbital. Five 5-pointed teeth in the inner series of the premaxillary on each side. Four smaller teeth in the outer row. One wide tooth at upper limit of maxillary.

Exposed surfaces of scales very deep and narrow, with few radial striae, little diverging. Scales over front of anal somewhat irregular and deflected towards the fin.

Dull, dark brownish, the scales prominently bordered with dark. A long vertical dark humeral bar with the suggestion of another a little way behind it. A faint dark lateral streak down posterior part of sides, ending in a slightly darker area at caudal base. A dark line to the tips of the central caudal rays. Dorsal and anal with dusky tips.

TYPE.—17,678a I. U. 47 mm. Brazil: Planaltina, Lagoa Fervedeira, Goyaz. 14 September, 1923. Carl Ternetz.

PARATYPES.—17,678 I. U. 31,570 M. C. Z. 23-60 mm. Brazil: Planaltina, Lagoa Fervedeira, Goyaz. 14 September, 1923. Carl Ternetz.

Differing markedly from the other species in the genus in the stuttering lateral line, the peculiar dusky color, the great depth, and numerous other characters. It is not related to any species of *Astyanax*, in which genus the specimens with a complete lateral line might be wrongly placed.

CREAGRUTUS ATRISIGNUM, sp. nov.

Head 4 in body-length. Depth $3\frac{1}{2}$. Eye 3 in head, slightly less than interorbital. Depth of caudal peduncle 2 in head. Dorsal $9\frac{1}{2}$. Anal 12. Scales $4\frac{1}{2}$ -35-3.

Dorsal origin an eye-diameter nearer to snout-tip than to caudal base, over insertion of pelvics. Pectorals not reaching pelvics by two scales. Pelvics almost reach anal fin. Anal origin far behind dorsal base, slightly anterior to vertical of tips of appressed last dorsal ray.

Great suborbital nearly or wholly as wide as eye-diameter, touching lower limb of preopercle but not ankylosed with it, leaving a considerable naked area at the angle and behind. Premaxillary dentition resembling that of *C. beni*. Two maxillary teeth.

Yellowish, scales of the back with dark bases. A narrow silvery lateral band, faint anteriorly, ending in a small caudal spot entirely within the band (sometimes very faint) and extending outward to the end of the middle caudal rays. A dark *horizontal* humeral bar entirely within the lateral band, and another small fainter brown spot (sometimes nearly absent) above and forward of it. Dorsal fin deeply flushed with black, pale basally. Caudal and anal dusky.

TYPE.—17,679 I. U. 60 mm. Brazil: Upper Rio Maranhão (Upper Tocantins), Goyaz. 11 October, 1923. Carl Ternetz.

PARATYPES.— 17,680 I. U. 31,571 M. C. Z. 59–67 mm. Brazil: Corrego do Monjolo, tributary of the Rio Maranhão. 30 September, 1923. Carl Ternetz.

The black dorsal and pleasing colors well mark this distinctive species.

CREAGRUTUS PHASMA, sp. nov.

Head $4\frac{1}{5}$ in body-length, equal to depth. Eye 3 in head, slightly greater than interorbital. Depth of caudal peduncle $2\frac{3}{4}$ in head.

Dorsal originating somewhat more than an eye-diameter nearer to snout tip than to caudal base, directly over insertion of pelvics. Pectorals not reaching pelvics by one or two scales. Pelvics not reaching anal by three scales. Anal inserted far behind dorsal, under tips of depressed last dorsal rays. Adipose inserted over base of last anal ray.

Great suborbital nearly as wide as eye; touching, but not ankylosed to, lower limb of preopercle, leaving a narrow naked border behind. Premaxillary dentition exactly as figured by Eigenmann (Mem. M. C. Z., 43, pl. 35, fig. 4) for *C. peruanus*.

Yellowish, the scales of the back with a dark border inside a lighter one. A large, conspicuous, vertical, dark humeral crescent (sometimes faint) over a deep black humeral spot entirely within the lateral band. A diffuse silvery band over a plumbeous one, wide anteriorly, narrow and more plainly defined posteriorly. The band ends at caudal base, then continues out to the tips of the central rays as a black line. A yellow spot at the base of upper and lower caudal rays, continued out strongly, forming a border for the dark streak. Caudal slightly dusky above and below the yellow spots. First rays of pelvics and anal milky white. Fins otherwise hyaline.

TYPES.— 17,681 I. U. 61, 65 mm. Venezuela: mouth of the Curamuni, Rio Cassiquiare. 7 March, 1925. Carl Ternetz.

A veritable ghost of the following genus, with which it was taken.

CREAGRUDITE, gen. nov.

κρεαγρευτος, tearing off the flesh, hence Creagrutus, and δίτην, having the force of born of.

GENOTYPE.— *Creagrudite maxillaris* Myers.

Tetragonopterinae. A specialized Creagrutus. Premaxillary teeth in a triple series in the young, formed of an inner series of large tricuspid teeth, four on each side, and a double outer series of three small teeth

on each side, the first and third set out to form the first series and the second one set back to form the second series. There are thus but two teeth, one on a side, in the second series. With age, this second tooth migrates forward and takes its place between the first and third tooth, so that in the adult there are but two series of premaxillary teeth.

The body-form is elongate and very little compressed, the head and jaws being particularly lengthened, so that the fish has a very characteristic physiognomy, resembling, but very distinct from *Creagrutus*. The snout is as long as the very large eye, and the widened postorbitals nearly equal it. The gape is very great. There is a considerable resemblance of the mouth to that of *Bramocharax* and of *Scissor*. The relationship may be in this direction.

The lengthened maxillary sweeps backward and downward in a great concave curve, its horizontal extent nearly twice the vertical. The maxillary is fully toothed to near its end, with twelve strong backward pointing tricuspid teeth.

There are two large tricuspid teeth on each side of the mandible, these grading into a series of nine strong retrorse tricuspid teeth. The snout is pointed so that all of the tooth-series are rather acutely angled in the middle and thence extend almost straight posteriorly.

The cheeks are fully armed with the exception of a narrow border along the vertical limb of the preopercle. The preventral and predorsal squamation is normal, the caudal is naked, and the lateral line complete.

This genus differs from *Creagrutus* in the dentition, in the long snout, and peculiar maxillary, in the elongated, uncompressed form, and in other characters. In Dr. Eigenmann's synopsis in the American Characidae, it would fall in *Hemibrycon*, from which it differs in the whole habitus, dentition, maxillary, and long snout.

CREAGRUDITE MAXILLARIS, sp. nov.

Head $3\frac{5}{8}$ in body-length. Depth 5. Eye $3\frac{1}{5}$ in head-length, somewhat greater than interorbital. Dorsal 10. Anal $10\frac{1}{2}$ to $12\frac{1}{2}$. Scales 4-41 to 42-3.

Body long, spindle-shaped, little compressed, greatest thickness $1\frac{1}{2}$ in depth. Eye large, equal to the long snout. Jaws about equal, the lower slightly included. Dorsal origin half an orbit-diameter nearer snout-tip than caudal base, slightly anterior to pelvic insertion in adults, over or slightly posterior to pelvics in younger specimens. Anal inserted under tip of depressed last dorsal ray. Pectoral tips half length

of fin from pelvics. Pelvics not reaching anal by three or four scales. Adipose inserted above last anal rays. Caudal well forked. Anal margin falcate, dorsal edge emarginate.

Yellowish, the scales of the back with a dark border inside a light one. A conspicuous vertical black humeral crescent. A diffuse silvery band, more sharply defined posteriorly, superimposed on a darkish band, ending abruptly at caudal base, discontinued for a short interval, and then continued to the tips of the central rays. A yellow spot at the base of the upper and lower caudal rays, continued faintly out to form a pale border to the caudal bar. Beyond the spots, the caudal is shaded duskily. First pelvic and anal rays milky white; fins otherwise hyaline.

TYPE.—17,682 I. U. 95 mm. Brazil: Sandbank on the Colombian border, Rio Negro, Cucuhy. 14 February, 1925. Carl Ternetz.

PARATYPES.—17,683 I. U. 31,572 M. C. Z. 92, 33 mm. Brazil: Sandbank on the Colombian border, Rio Negro, Cucuhy. 14 February, 1925. Carl Ternetz.

PARATYPES.—17,684 I. U. 49, 58 mm. Mouth of the Curamuni, Rio Cassiquiare. 7 March, 1925. Carl Ternetz.

Creagrus melanzonus Eigenmann, from the Upper Essequibo and Potaro Rivers in British Guiana, seems to be based on young specimens of this genus, and may stand as *Creagrudite melanzona* (Eigenmann). They differ from young *C. maxillaris* in the scale-count and in the presence of two teeth in the second premaxillary series on each side.

CARNEGIELLA MARTHAЕ, sp. nov.

Head $3\frac{2}{3}$ in body-length. Depth 2. Dorsal 10. Anal 22 or 23. Scales 26.

Lower profile of the disc extending downward and backward rather steeply and with but a slight curve, the lower portion somewhat truncated. Maxillary with a single tooth. Nine premaxillary teeth on each side in a single series. Lateral line incomplete. No adipose.

A dark line from above the first third of the pectoral to the caudal base, bounded above by a wider light line and below by a narrower one. Back above this darkly mottled, the scale-edges darker. A dark band around lower jaw to eye and another a little lower down. Two dark lines backward from eye across opercle, and another following the curve of the suborbital. Entire lower edge of body, from caudal to chin, bounded by a narrow dark line, this forking on the breast, one branch on each side, leaving a narrow median light V-shaped area below chin.

This dark outline is bordered interiorly, from caudal to the beginning of the front profile of the breast, with a wider light area. Breast with a series of six fine curved dark lines, with wider interspaces, starting anteriorly and curving backward and upward, parallel with the lower edge of the opercle, somewhat converging, and ending above and behind the pectoral insertion. The sides are finely mottled with dark and this causes the lines to become obsolete on the middle of the sides in most specimens. The lower ones of the six are nearly always interrupted. At the point where the truncated lower profile starts upward towards the caudal, the light inner margin is curved inward, with an upper heavy border of crowded chromatophores, forming an incipient light spot. Pectorals mottled with dusky. Scales bluish burnished silvery. These are the typical colors. They are varied somewhat on most of the specimens by slight differences in mottling.

TYPE.—17,685 I. U. 29.5 mm. Venezuela: Caño de Quiribana, near Caicara. May, 1925. Carl Ternetz.

PARATYPES.—17,686 I. U. 31,573 M. C. Z. 27–32 mm. Venezuela: Caño de Quiribana, near Caicara. May, 1925. Carl Ternetz.

PARATYPES.—17,687 I. U. 30, 31 mm. Venezuela: Caño de Quiribana, opposite Pan de Azucar. 7 May, 1925. Carl Ternetz.

PARATYPE.—17,688 I. U. 29 mm. Venezuela: Creek into Laguna San Raphael, Caicara. 23 April, 1925. Carl Ternetz.

This pretty and distinctive little flying fish is one of the most unexpected novelties obtained by Dr. Ternetz. It differs trenchantly from the only other species of the genus, *C. strigata*, in the low scale and anal ray counts, in the truncated lower profile of the disc, and in the similarly patterned, but quite distinct coloration; *C. marthae* entirely lacks the bold wavy cross-bands of *C. strigata* and is considerably smaller. An average adult *C. strigata* from Iquitos measures 40 mm.; I have compared it with *C. strigata* from Belem, Pará (Ternetz), Iquitos (Allen), and Tumatumari, British Guiana (Eigenmann); *C. marthae* apparently replaces *C. strigata* in the Orinoco, but why the latter should occur in the Essequibo and the Marañon and not in the Orinoco, when the latter is openly connected with the Amazon system through the Cassiquiare, is an interesting question. Dr. Ternetz does not appear to have obtained any Gasteropelecinae in the Upper Rio Negro or Upper Orinoco.

LONCHOGENYS, gen. nov.

λόγχη, lance, and γένος, cheek.

GENOTYPE.—*Lonchogenys ilisha* Myers.Characinae. Allied to *Acanthocharax*, *Heterocharax*, and *Xiphocharax*.

Lateral line complete. Anal origin beneath the dorsal fin. Scales large, cycloid. A strong acute point on the angle of the interopercle. Mandibular teeth in two series. Tooth-bearing margin of the mandible trilobed, the central lobe with a large and a small canine on each side of it in the inner series, the side lobes each with three large retrorse canines at their highest point, these being in the outer series. Upper jaw scalloped to receive the central lobe, the depression with two canines and a few smaller teeth at each side of it. Set in front of these canines is an even row of small teeth, forming two premaxillary series at this portion of the jaw. Maxillary-premaxillary junction a right angle, the maxillary immediately curving down and sweeping backward. Maxillary fully toothed, without a canine, the upper teeth enlarged and grading downward.

Head much less heavy and gape considerably less than in *Acanthocharax*. Nape emarginate, not angulated. Snout broadened, as in *Heterocharax* and *Xiphocharax*. Cleithrum not notched. Opercle with a deep notch in its upper border, deeper than that of *Heterocharax*, and corresponding to a slight emargination in the other two genera.

This genus is far removed from *Acanthocharax*, much nearer *Xiphocharax*, and closest to *Heterocharax*. The four genera may be arranged as follows:—

- a. Genera of Characinae with the interopercle drawn out into a sharp point or spine.
- b. Maxillary-premaxillary junction very obtusely angled, the maxillary oblique; a small canine at the upper end of the toothed maxillary; snout not broadened; nape angulated; scales small; cleithrum notched; opercle entire; cheeks mostly naked; interopercle with a sharp spine.
Acanthocharax Eigenmann.
- bb. Maxillary-premaxillary junction nearly a right angle; the maxillary with the upper teeth enlarged, but no canine; snout broadened; nape emarginate but not angled.

- c. Cheeks naked; cleithrum notched; opercle entire; scales very small; maxillary vertical; interopercle with a sharp point but not a spine. *Xiphocharax* Fowler.
- cc. Cheeks fully armed; cleithrum not notched; opercle notched; scales large; maxillary oblique.
- d. Ramus of mandible trilobed; premaxillary teeth partly in two series; interopercle with an acute point; scales squared basally with a notch. *Lonchogenys* Myers.
- dd. Ramus of mandible not lobed; premaxillary teeth strictly in a single series; interopercle with a sharp spine; scales deep, oval, basally entire. . . . *Heterocharax* Eigenmann.

LONCHOGENYS ILISHA, sp. nov.

Head $3\frac{1}{2}$ in body-length. Depth $2\frac{3}{4}$. Eye $2\frac{1}{3}$ in head, much longer than snout. Dorsal 11. Anal 35 to 38. Scales 6-34 to 35-4.

Nape slightly emarginate, not angulated. Dorsal originating very slightly nearer to caudal base than to snout-tip. Pelvics half an orbit-diameter anterior to vertical of dorsal origin. Pectorals not quite to pelvics, which scarcely reach anal. Adipose above end of anal. First few anal rays prolonged, giving a falcate margin to the first part of the fin. Dorsal high and pointed. Caudal well forked, lobes pointed. Occipital process long and pointed. Maxillary reaches nearly to below center of pupil. Predorsal line compressed, possibly nearly naked, but with scattered irregular scales; this hard to determine precisely because of the black predorsal line. Scales at side of predorsal line, particularly anteriorly, becoming very oblique. Anal with a basal sheath of scales, more numerous forward. Caudal scaled. Great sub-orbital covering all but a very narrow line of the cheeks.

The scales are most remarkably different from those of *Acanthocharax* (cf. Cockerell, Ann. Carnegie mus., 1914, 9, p. 111) and of *Heterocharax*, with both of which I have directly compared them. The scales of *Heterocharax* are exactly like those of *Acanthocharax* except that they are less deep. The scales of *Lonchogenys* are rounded apically, more or less square basally, not exceptionally deep, and of course much larger than those of *Acanthocharax*. The nucleus is far basad, and the basal border is *notched* twice medially and once below, the circuli following the indentations. There are two widely separated strong apical radii, delimiting the apical sector of the scale, this area lacking circuli. Between these radii are several fine, irregular, connected radii, few reaching the margin. The circuli of the basal portion run

around and go off the scale parallel to the two strong delimiting apical radii.

Coloration brilliant silvery; a plumbeous lateral band. Fins hyaline, slightly dark tipped. Midline of back, occiput, upper iris, and tips of jaws black. Scales dark edged on back. A dusky line along anal base. A few chromatophores gathered into faint lateral scale-lines below.

TYPE.—17,696a I. U. 67 mm. Brazil: Sandbank on the Colombian border, Rio Negro, Cucuhy. 14 February, 1925. Carl Ternetz.

PARATYPES.—17,696 I. U. 31,574 M. C. Z. 67–74 mm. Brazil: Sandbank on the Colombian border, Rio Negro, Cucuhy. 14 February, 1925. Carl Ternetz.

There are many specimens from other localities. It is a common species in the Upper Rio Negro. That this species passes through the Cassiquiare to the Orinoco is shown by a single specimen of 77 mm. from Laga Tama-Tama, Bifurcation, Upper Orinoco.

A replica in miniature of the clupeid genus *Ilisha*.

PIMELODIDAE.

BRACHYRHAMDIA, gen. nov.

βραχῦς, short, and *Rhamdia*, a genus of Pimelodidae.

GENOTYPE.—*Brachyrhamdia imitator* Myers.

Pimelodinae. Allied to Pimelodella.

Body rather compact; somewhat compressed and deep. Occipital process forming a bridge with the dorsal plate. Dorsal and pectoral spines pungent, those of the latter with thorns along the basal half of the posterior edge. Humeral process spine-like. Fontanel not continued behind eyes, without a bridge. Eyes with free orbital rims. Barbels normal. Caudal deeply forked. Head entirely covered with skin.

BRACHYRHAMDIA IMITATOR, sp. nov.

Head $3\frac{1}{2}$ in body-length. Depth $3\frac{1}{2}$. Eye $3\frac{1}{4}$ in head, circular. Dorsal I, 6. Anal 9.

Body in general shape like *Corydoras*, the head deep and the skull arched. Maxillary barbel lying in a groove below eye, long, reaching tip of anal rays. Outer mental barbel nearly reaching tip of pectoral spine. Inner mental barbel shorter. Premaxillary teeth in a band, without backward projecting angles. Pectoral spines very slightly

longer than dorsal spine, the latter smooth, the former with eight strong thorns along the basal half of the posterior margin. Dorsal origin $1\frac{1}{2}$ times as far from caudal base as from snout-tip. Pelvics inserted on vertical of next to last dorsal ray. Adipose fin high, the length of its base slightly less than length of dorsal spine.

Dull brownish yellow, light on belly. Posterior sides finely mottled. A black masque-like zone from occiput down over eyes and across cheek. Another wide black zone from dorsal origin to humeral process, this running up and involving the spine and first ray of dorsal.

TYPE.—17,695 I. U. 50 mm. Venezuela: Caño de Quiribana, near Caicara. May, 1925. Carl Ternetz.

Taken with, and very similar in color and form to *Corydoras melanistius* Regan.

DORADIDAE.

ORINOCODORAS, gen. nov.

Orinoco and Doras, the typical genus of the family.

GENOTYPE.—*Orinocodoras eigenmanni* Myers.

Allied to *Platydoras* and *Lithodoras*. Width at cleithrum greater than head-length. Adipose fin continued forward very slightly into a keel, fairly high; without the keel it is as long as anal base. Dorsal spine strongly serrate in front and behind, the posterior serrae longer. Preorbital bones not serrate. Caudal peduncle entirely covered above and below with laminate plates. Lateral scutes very narrow, as wide as eye, leaving the greater part of the sides naked; one in feeble contact with the dorsal plate. Swim-bladder double, without diverticula, the posterior part small and heart-shaped. Barbels simple. Differs from *Lithodoras* in the armored peduncle and more numerous scutes, and from *Platydoras* in the narrow scutes.

ORINOCODORAS EIGENMANNI, sp. nov.

Head $3\frac{1}{3}$ in body-length to last scute. Eye $6\frac{1}{3}$ in head. Dorsal I, 5. Anal, 11. Lateral scutes 29, very even, those on the peduncle very slightly larger than the others. Dorsal spine nearly reaches beginning of adipose keel. Pectoral spines reaching pelvics. Coracoid process covered with skin. Fontanel continued as a groove to the dorsal fin. Mouth terminal. Teeth in a band, none enlarged. Maxillary barbel reaching to cleithrum. Mental barbels four, short. Eye just anterior

to middle of head. Profile from dorsal to snout-tip an almost uninterrupted curve. Caudal forked.

Blackish; a white line down the row of scutes, continued faintly forward to eye. Dorsal lightish mottled, the first soft ray and its membrane black. Caudal mottled lightish, with two longitudinal black bands, these continuing the black of the sides above and below the white scutes. Underside of head and coracoid process white, rest of underside darkly mottled.

TYPE.—17,689 I. U. 89 mm. Venezuela: Caño de Quiribana, near Caicara. 13 May, 1925. Carl Ternetz.

PARATYPES.—17,690 I. U. 31,575 M. C. Z. 74–81 mm. Venezuela: Caño de Quiribana, near Caicara. Carl Ternetz.

Named for Dr. Carl H. Eigenmann, who recently placed the classification of the Doradidae on a firm foundation.

ASPREDINIDAE.

BUNOCEPHALUS SALATHEI, sp. nov.

Depth of head $2\frac{1}{2}$ in its width, which is half again greater than its length. Upper jaw slightly longer than lower. Cranial ridges prominent, interorbital deeply concave, half as wide as corresponding width of head. Maxillary barbels reach almost to end of coracoid processes. Pectoral spine slightly curved, with strong serrations on both sides, not reaching pelvic fin-origin by more than half head-length. Coracoid processes parallel or slightly divergent, half as long as their distance apart, reaching as far back as middle of pectoral spine. Dorsal 4, its origin $1\frac{2}{3}$ times as far from caudal base as from snout tip. Anal $7\frac{1}{2}$. Caudal peduncle little or not at all compressed, very slender, its length $4\frac{2}{3}$ in length to caudal base. Skin finely tubercular.

Upper half of head and body light grayish tan, lower half blackish brown. Dorsal fin dark with a lightish border. Venter light. Two of the paratypes show traces of five dark cross-bands, near the end of the pectoral spines, at the dorsal fin, above the anal origin, above its end, and at the caudal base.

TYPE.—31,583 M. C. Z. 48 mm. Brazil: Morro Ajudo, "about 100 km. from Rio de Janeiro." Brocca and Salathé.

PARATYPES.—101 Coll. G. S. M. 26–33 mm. Brazil: Morro Ajudo, "about 100 km. from Rio de Janeiro." Brocca and Salathé.

Allied to *B. doriae* Blgr. differing in the anterior dorsal, uncompresssed peduncle, shorter dorsal, and in color.

CALLICHTHYIDAE.

CORYDORAS POTAROENSIS, sp. nov.

Corydoras punctatus Eigenmann (in part *nec* Bloch) Mem. Carnegie mus., 1912, 5, p. 220, pl. 24, fig. 3. Creek below Potaro Landing and Erukin.

In his account of *C. punctatus*, Eigenmann apparently included specimens of two distinct species, neither of them the true *C. punctatus* of Bloch. Bloch's figure represents a fairly elongate *Corydoras* with a distinct black spot on the upper part of the anterior dorsal rays, with but few small dots on the sides, with no trace of a black band across the head and eyes, and with rows of dots on the caudal. It would fall in the group *nm.* of Mrs. Ellis's synopsis (Ann. Carnegie mus., 1913, 8, p. 398). Regan, whose paper (Ann. mag. nat. hist., 1912, ser. 8, 10, p. 209-220) appeared almost simultaneously with Eigenmann's, recognized that the one Guiana species he had was different from *C. punctatus*, and named it *C. melanistius*. I identify the more common species of Eigenmann's collections with *C. melanistius*, while the other I describe as new; *C. melanistius* is a very deep species (the depth $2\frac{1}{3}$ to $2\frac{1}{2}$). Measuring in a horizontal plane (not over the curve of the back), the dorsal origin is midway between the vertical of the snout-tip and the tip of the adipose spine. The spine and first three dorsal rays and their membranes are black, this color extending down in a large patch on the upper part of the sides. A dark band (though never so dark as the dorsal spot) extends from the nape down through the eye onto the sub-orbital and opercle. Sides covered with many small dark spots, those above the lateral line of scute-junctures slightly larger and more disposed in lateral rows than those below. Fins pale, faded, but with indications in some specimens (Konawaruk) of vertical rows of spots on the caudal and anal. I have specimens from Kumaka, Malali, Konawaruk, and mud-flats on the Demerara below Wismar. All these are much paler in coloration than specimens from Caño de Quiribana, near Caicara, Orinoco, possibly due to fading, but more probably partly due to a really lighter color of the Guiana fishes. The Orinoco specimens have the caudal with bold rows of spots.

The new species, represented by Eigenmann's figure and his specimens from Erukin and Potaro Landing, is more elongate. Depth $2\frac{2}{3}$ to 3. Measuring in a horizontal plane, the dorsal origin is midway between the vertical of the snout-tip and the *base* of the adipose spine. There is a masque-like black zone over the eyes as in *C. melanistius*, but the dorsal coloration differs widely. The entire dorsal fin, with its rays and

membranes, is black, paling toward the margin, but this color *does not extend on the dorsal region of the body*. There are *no spots on the body or fins*, the only markings being faint lines running parallel to the vertical plate-sutures.

TYPES.—11,984 I. U. 31,576 M. C. Z. 43–46 mm. Br. Guiana: Creek below Potaro Landing. C. H. Eigenmann.

LORICARIIDAE.

OTOTHYRIS, gen. nov.

oûs, ὠτός, ear, and *thýris*, lattice.

GENOTYPE.—*Otothyris canaliferus* Myers.

Hypoptopomatinae. Allied to *Otocinclus*, but the cranium sculptured in a most remarkable manner. Eye set high in head, without the projecting tongue of iris to the center of the pupil seen in *Otocinclus*.

Supraoccipital with two low spinescent keels at the summit, one on each side, parallel, diverging anteriorly and posteriorly. Out of the posterior trough of these rises a third median spinescent keel, higher than the other two and rising to the posterior tip of the supraoccipital, where it ends. The temporals are perforate, pierced by three or four large openings (sometimes confluent into one), these extending upward into a passageway which opens externally above into two small holes. The sutures of the bones are so obscured that I shall not attempt to differentiate them further. A keel starts on each side of the snout and extends in a concave curve upward to, and encircling, the eye, thence extends backward and upward above the perforations described, ending in a pointed backward projection of what likely is the epiotic. Occasionally there is one perforation above this keel, this at its angle with the posterior border of the circumorbicular ridge, and extending downward into the same passageway as the others. Below the posteriorly projecting point of the lateral cephalic keels is a cavernous bone-surrounded opening into a large chamber at the side of the anterior vertebrae. This apparently does not connect with the passageway of the perforations, agreeing in this with specimens of *Otocinclus affinis* Steindachner from Rio de Janeiro. Thus it apparently differs from the structure in *O. vestitus* as described by Cope, although he may have been mistaken in that all of the perforations enter the large cavity.

The bony arched roof of the chamber on each side, between the lateral and supraoccipital keels, bears four very weak longitudinal

keels. There is a short double keel originating at the snout-tip and fading between the great bone-rimmed nasal depressions.

The adipose fin and its spine are absent. There are three large plates on the preventral area, one at each side anteriorly and one posteriorly between the pelvics. The rest of the breast is naked save occasionally for one or two rudimentary accessory plates. Lower transverse area of clavicles and coracoids exposed, rough.

This genus differs from *Otocinclus* in the rugose and much keeled upper surface of the head, and in the reduced number and peculiar structure of the temporal perforations and their canals.

OTOTHYRIS CANALIFERUS, sp. nov.

Dorsal I, 4. Anal I, 5. Lateral plates 21.

Summit of postdorsal region depressed, with a row of spines along each side. A median series of scutes down the side. Postanal region depressed, flanked on each side by a row of spines, with another double row down its center. Dorsal originating very slightly posterior to vertical of origin of pelvics. Pectoral spines extending nearly to end of pelvics. Caudal injured, possibly truncate in life.

Ornately mottled, a diffuse brown band over back at dorsal origin and another at its end. Caudal peduncle encircled by a diffuse band. A lateral brown area down the sides. A conspicuous rounded dark brown spot occupying the center of the caudal fin.

TYPES.—87 Coll. G. S. M. 31,577 M. C. Z. 30 mm. Brazil: hills vicinity Rio de Janeiro. 1924. R. Brocca.

I cannot identify this species with any described from southeastern Brazil, though there is a possibility that it will prove identical with one of Ribeiro's species of *Otocinclus*.

PYGIDIIDAE.

GLANAPTERYX, gen. nov.

γλavis, the catfish of Aristotle; α, privative, without; and πτέρυξ, wing or fin.

GENOTYPE.—*Glanapteryx anguilla* Myers.

Pygidiinae. Body eel-shaped, wholly finless excepting for small rudimentary pectoral and pelvic flaps and a caudal fringe. No mental barbels. Nasal, rostral, and maxillary pairs of barbels present. Cheeks without spines. Teeth small, apparently conical, in both jaws.

GLANAPTERYX ANGUILLA, sp. nov.

Body cylindrical anteriorly, compressed and slightly deeper in the caudal region. Eyes small and imbedded in the skin, about thrice one's diameter apart, far forward in the head near the nasal barbels. Head small and flattened, its length equal to depth of anterior part of body, which is contained about fifteen times in the body-length. Nasal barbels reaching end of head, rostral and maxillary barbels slightly longer.

No traces of dorsal or anal fins are visible. The pectorals are reduced to useless inconspicuous fleshy flaps. The caudal fin, with its many accessory rays, is present as a narrow fringe around the caudal end of the body, rounded-acuminate at the tip. What may be flap-like remnants of the pelvic fins are present at each side of the anus. A dissection to ascertain this has not been made as the Type is unique. The caudal region, from vent to caudal tip, is contained $3\frac{2}{3}$ times in the total length of the fish.

Uniform dark brown, lighter beneath.

TYPE.—17,700 I. U. 42 mm. Brazil: rock-pools below São Gabriel Rapids, Rio Negro. 1 February, 1925. Carl Ternetz.

This unique specimen was in a vial full of young *Synbranchus marmoratus*, and it was not until I noticed one of the supposed *Synbranchus* to have barbels that this peculiar species was discovered. It is undoubtedly a burrowing type and is quite the most remarkable form of the subfamily so far discovered.

OCHMACANTHUS ALTERNUS, sp. nov.

Head $5\frac{1}{2}$ in body-length. Depth $5\frac{1}{3}$. Dorsal 8. Anal 8. Pectoral 6. Eye $4\frac{1}{2}$ in head, longer than snout, less than interorbital.

Maxillary barbels to interopercular spines; lower barbels much shorter, with a membranous flap below. Width of head equal to length with opercular spines. Ten or eleven interopercular spines. About ten opercular spines. Teeth small, in minute series. A prominent pectoral pore. Pelvics inserted midway between head and caudal base. Anal fin-origin but slightly behind that of dorsal. Caudal rounded-truncate, with many accessory rays, not tadpole-like.

Markings very variable, typically a double or triple series of large, irregular, alternating blotches with narrow interspaces, the spots usually partially coalescing forward on the back. Some specimens have the pattern broken up into comparatively fine mottling, but all show a

trace of the typical pattern. Caudal mottled, in some with a trace of a dark median streak to the tip. Venter pale, unmarked.

TYPES.—17,697 I. U. 31,578 M. C. Z. 34–40 mm. Venezuela: Caño de Quiribana, near Caicara. May, 1925. Carl Ternetz.

A larger headed, more compact species than *O. orinoco*, well distinguished by its bold dark pattern.

OCHMACANTHUS ORINOCO, sp. nov.

Head 6 in body-length. Depth $6\frac{2}{3}$. Dorsal 8. Anal 7. Pectoral 5. Eye 4 in head, equal to snout and interorbital.

Maxillary barbels reaching middle of interopercular spine-patch, lower barbels much shorter, with a membranous flap below. Head flattened, its width equal to its length with opercular spines. Ten large spines in interopercular patch, ten or twelve in the opercular patch. Teeth of premaxillary very small, in fine series as in *Stegophilus*. A prominent pectoral pore. Pelvics inserted midway between caudal base and front of interopercular spine-patch. Anal origin under last part of dorsal base. Caudal rounded, with many accessory rays, not tadpole-like.

Back mottled. A single series of oblong dark patches of unequal length down the middle of the sides to caudal base.

TYPE.—17,698 I. U. 46 mm. Venezuela: Playa Matepalma, Orinoco. 2 April, 1925. Carl Ternetz.

STEGOPHILUS SEPTENTRIONALIS, sp. nov.

Head $5\frac{4}{5}$ in body-length. Depth $6\frac{3}{4}$. Dorsal 8. Anal 6. Pectoral 7. Eye equal to snout and interorbital, 4 in head.

Maxillary barbels reaching the interopercular spines, lower barbel much shorter; an attached membranous flap below the lower barbel. Head flat below, its width equal to head without the opercular spines. Ten or eleven long sharp hooks in two irregular series on the interopercle. About twelve shorter hooks irregularly arranged at tip of opercle. Teeth in several minute, even series in the premaxillaries, less numerous than in *Haemomaster*; two series on the lips. Pelvic fins inserted midway between caudal base and pectoral tips. Anal inserted under end of dorsal base. One or two prominent accessory dorsal and anal rays. Caudal emarginate.

Whitish; a series of oblong dark blotches down the middle of the side, these becoming obsolete forward. An indefinite series of small,

diffuse streaks above the side series anteriorly, and another on midline of back. A small black spot on base of central caudal rays, continued outward as a straight black line to the end of the central rays. Upper and lower caudal tips mottled.

TYPE.—17,699 I. U. 44 mm. Venezuela: Santa Barbara, Orinoco. 4 April, 1925. Carl Ternetz.

Very close to the only other known species of the genus, *S. insidiosus* Reinhardt, from southeastern Brazil apparently differing only in one anal ray, the emarginate caudal, and the distinctive color.

HAEMOMASTER, gen. nov.

αἷμα, blood, and μαστηρ, seeker.

GENOTYPE.—*Haemomaster venezuelae* Myers.

Stegophilinae. Accessory caudal rays fairly numerous, but not conspicuous. Gill-membranes united, confluent with the isthmus. Opercle with five spines. Caudal very slightly emarginate. Pelvic fins inserted nearly twice as far from snout-tip as from caudal base. Eyes large, staring, *far apart* and *lateral*, not superior and close together as in related genera. Colorless except for a caudal stripe.

In the synopsis of genera in Eigenmann's review of the family, this genus would fall in Stegophilus, but the wide-set, staring, lateral eyes are seen in no other member of the subfamily. It cannot well be Pleurophysus Ribeiro.

HAEMOMASTER VENEZUELAE, sp. nov.

Head $7\frac{1}{2}$ in body-length. Depth $6\frac{2}{3}$ to $7\frac{1}{2}$. Dorsal 7. Anal 5. Eye $3\frac{1}{2}$ in head, 2 in interorbital.

Teeth of upper jaw imbedded in soft flesh and very difficult to see except in dry specimens. The tooth-bearing area is very wide and extends to the sides of the mouth. The teeth are extremely fine and are disposed in many even series, the outer one along the lip. As many as fifteen of these series can be counted. In the middle there is a patch of enlarged retrorse teeth. In the mandible the teeth are similar, in extremely fine rows, less numerous than in the upper jaw, and there appears to be no enlarged central patch. The outer series is along the lip.

A very short maxillary barbel, scarcely reaching hind border of eye. Interopercular spines five, four large and one very small one above. Opercular spines six, four large ones in the second series, two smaller in the first. Dorsal inserted above middle of appressed pelvics. Anal

inserted below end of dorsal base. Pelvics nearly twice as far from snout-tip as from caudal base. Head very flat, body compressed posteriorly.

Body colorless. Eyes dark. A dark line from middle of sides below dorsal, growing black at caudal base, where it widens slightly, and extending out to the tips of the central caudal rays. Occiput dark.

TYPE.—17,705 I. U. 61 mm. Venezuela: Playa Matepalma, Orinoco. 2 April, 1925. Carl Ternetz.

PARATYPES.—17,706 I. U. 49, 58 mm. Venezuela: Santa Barbara, Orinoco. 4 April, 1925. Carl Ternetz.

PARATYPES.—17,707 I. U. 31,579 M. C. Z. 55-66 mm. Venezuela: Playa Tama-Tama, Bifurcation, Orinoco. 14-16 March, 1925. Carl Ternetz.

URINOPHILUS DIABOLICUS, sp. nov.

Head $6\frac{3}{4}$ in body-length. Depth $8\frac{3}{4}$. Dorsal 7. Anal 8. All rays visible counted. Pectoral 7. Eye 6 in head with opercular spines, just anterior to middle of head-length.

Maxillary barbel extending not quite to tip of interopercular spines, lower barbel rudimentary. Interopercle with a single greatly enlarged spine and a very few (one or two) tiny complementary ones. Opercular patch of spines rudimentary, hidden beneath the skin and not projecting. Five premaxillary teeth in a convex semicircle, the central one largest. Mandibles widely separated, each with a patch of small teeth. Pelvic fin-origin midway between pectoral tip and caudal tip. Anal origin beneath middle of dorsal. Dorsal origin twice as far from interopercular spine-patch as from caudal base. Caudal peduncle slender, with supplementary rays inconspicuous. Caudal truncate or slightly emarginate.

Brownish, with fine darker brown chromatophores on back.

TYPE.—17,701 I. U. 48 mm. Peru: Iquitos. September, 1920. W. R. Allen.

Dr. Allen found this specimen (called "Carnero" in Peru) halfway buried in the belly of a large river catfish, "Doncella" (*Pseudoplatystoma*). It had burrowed directly through the body-wall and was distended with blood.

This species is much less elongate than *U. sanguineus* (Eigenmann) and *U. erythrurus* Eigenmann.

CYPRINODONTIDAE.

RIVULUS BENIENSIS, sp. nov.

Rivulus strigatus Pearson, (*nec* Regan) Indiana univ. studies, 1925, no. 64, p. 51.

Allied to *R. strigatus*. Scales 34 or 35. Dorsal 7. Anal 11 or 12. Anal ending below middle of dorsal. Depth $4\frac{2}{3}$. Male with dark brown longitudinal lines between the scale-rows and no caudal ocellus. The light interspaces were red in life. Fins darkish, a basal line on anal fin. Female with traces of the lateral dark lines, but this developed into a regularly mottled pattern which forms more or less well-defined squarish light areas on the lower posterior part of the sides. A very irregular dark streak from under jaw, through eye, to above pectoral. Fins speckled, anal dark edged. A very large black caudal ocellus in the female.

RIVULUS BENIENSIS BENIENSIS, subsp. nov.

Head 4 in body-length. Dorsal fin originating twice as far from vertical limb of preopercle as from caudal base.

TYPES.— 17,259 I. U. 31,580 M. C. Z. 24–40 mm. Bolivia: Ivon, Rio Beni. February, 1922. N. E. Pearson.

RIVULUS BENIENSIS LACUSTRIS, subsp. nov.

Head $4\frac{1}{2}$ to $4\frac{2}{3}$ in body-length. Dorsal fin originating twice as far from middle of pectoral as from caudal base.

TYPES.— 17,258 I. U. 31,581 M. C. Z. 30–42 mm. Bolivia: Lagoons along shores of Lake Rogoagua. November, 1921. N. E. Pearson.

Rivulus strigatus lacks a caudal ocellus in both male and female and the pattern consists of opposed oblique bars of dark red and blue meeting at the midline of the sides, less bright in the female. Living individuals of *R. strigatus* are very different from *R. beniensis*.

ELEOTRIDIDAE.

MICROPHILYPNUS, gen. nov.

μικρος, small, and *Philypnus*.

GENOTYPE.— *Microphilypnus teruetzi* Myers.

Eleotridinae. Gill-openings extending forward to below hind border or center of pupil. Isthmus moderately narrow. Vomerine teeth ap-

parently absent. Skull without ridges posteriorly, slightly ridged or irregular anterior to orbits. Interorbital very narrow. Head and snout more or less elongate. Lower jaw projecting. Scales large. Opercles and occiput scaled. Cheeks and breast naked. Size minute.

Distinguished from *Philypnus* by the minute size, large scales, and unridged skull. These are the first small river gobies to be reported from the interior of South America.

MICROPHILYPNUS TERNETZI, sp. nov.

Head $3\frac{2}{3}$ in body-length. Depth $5\frac{2}{3}$. Eye $3\frac{2}{3}$ in head. Dorsals V, 8. Anal 7. Scales 29 lateral, 7 between dorsal and anal.

Gill-openings extending to opposite hind border of pupil. Snout rather short, shorter than eye. Lower jaw not extremely prognathous. Maxillary extending backward to beneath anterior border of pupil. Scales ctenoid. Lateral line absent. Tongue emarginate or notched at tip. No bony point on end of lower limb of preopercle, below eye. No ridge before eye.

Scales dark edged, some with a spot on the posterior margin. Head and opercles dark spotted. A dark line midventrally, from isthmus to caudal, expanding at intervals into small elongate spots.

Types.—17,702 I. U. 31,582 M. C. Z. 14–20 mm. Venezuela: Caño de Quiribana, near Caicara. May, 1925. Carl Ternetz.

In a 20 mm. female, numerous, large, yellow ova can be seen through the abdominal wall. This species vies with *Eviota* and *Mistichthys* as the smallest known vertebrate.

MICROPHILYPNUS AMAZONICUS, sp. nov.

Head $3\frac{1}{2}$ in body-length. Depth 6. Eye 3 in head. Dorsals VI, 8. Anal 8. Scales about 27 lateral,¹ 6 or $6\frac{1}{2}$ between dorsal and anal.

Gill-openings extending to opposite hind-border of pupil. Snout rather short, shorter than the eye. Eye very large, elongate-oval. Lower jaw not extremely prognathous. Maxillary extending backward to beneath anterior border of pupil. Scales ctenoid. Lateral line absent. Tongue large, shallowly but widely bifid at the end. A bony point on end of lower limb of preopercle, below eye. Anterior border of orbit raised into a high bony ridge.

Yellowish; a series of dark spots down the middle of the side, one on

¹ Approximate number. Actual number possibly less. Scales mostly lost.

every third scale. Fins spotted. A line downward from eye to edge of under jaw.

TYPE.—17,703 I. U. 24 mm. Brazil: Igarapé do Mai Joana, Manaus. 12 December, 1924. Carl Ternetz.

This species and the next are probably not congeneric with *M. ternetzi* or with each other, but I hesitate to erect new genera on the poor material available.

MICROPHILYPNUS MACROSTOMA, sp. nov.

Head $3\frac{2}{5}$ in body-length. Depth 5. Eye $3\frac{1}{4}$ in head. Dorsals V, 10. Anal 10. Scales 24 lateral, 5 between dorsal and anal.

Gill-openings extending forward almost to opposite end of maxillary. Head elongate, low, very pointed, snout long but shorter than the large eye. Lower jaw extremely prognathous, the lower dentition exposed. Maxillary extending backward to beneath center of pupil. Scales ctenoid. Lateral line present in the form of pits or elongate indentations. Tongue large, squared or slightly emarginate at the end. A bony point on end of lower limb of preopercle, below eye. Anterior border of eye with a ridge which is raised into a blunt excrescence at one point.

Yellowish, faintly speckled.

TYPE.—17,704 I. U. 20 mm. Brazil: Igarapé do Mai Joana, Manaus. 23 December, 1924. Carl Ternetz.

Very probably the type of a distinct genus.

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NOTES ON SOME ARGENTINA BIRDS.

BY HERBERT FRIEDMANN.

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NO. 4.— *Notes on some Argentina Birds.*

BY HERBERT FRIEDMANN.

INTRODUCTION.

IN early August 1923, under a grant from the National Research Council, I sailed from New York for Argentina to make an intensive study of the life-histories of the three species of cowbirds known to occur in that country. The work involved kept me in the field for approximately half a year, during which time several sections of the country were visited. While the cowbirds were the main object of the expedition other birds were studied and collected whenever time permitted. This report deals with the latter part of the results of the trip. The work on the cowbirds forms a separate report.

ITINERARY.— In the morning of August 11, 1923 I left New York on the Lamport and Holt steamer *VESTRIS* and two days later stopped at Bermuda for a few hours. On August 26 the highlands of Cape Frio appeared through the mists at dawn and about noon the boat was docked in the harbor of Rio de Janeiro. The next afternoon anchor was raised, to be lowered again on August 30 at Montevideo, where a stop was made for the day, proceeding that night to Buenos Aires.

Buenos Aires was my headquarters for the duration of my stay in Argentina and to this city I returned for reoutfitting after each trip into the different sections of the country. In Buenos Aires Dr. Roberto Dabbene, the Curator of Birds in the Museo Nacional, very kindly gave me access to the splendid collections under his care and helped me greatly with advice as to the most likely places to visit for my work, and with letters of introduction to resident naturalists in the parts visited. The success of the expedition is in no small measure due to his friendly interest in it. From September 1 to 20 I was in or around Buenos Aires outfitting for my first excursion into the interior, but managed to make a few short side trips during this time. Two trips to La Plata City, Berisso, and Ensenada took up a week, while the others were one-day trips. On the morning of September 20 I left by the Central Argentine Railway for Tucuman City in the northwest part of Argentina. Arriving there the following morning after a very comfortable and interesting journey I made the acquaintance of three resident naturalists, Dr. Lillo, Señor Schreiter, and Señor Venturi.

The last-named invited me to join him on the next day on a short trip into the eastern foothills of the Andes at San Pablo and the Rio Lules. It was on this trip that I got my first real impressions of many Argentine birds and, incidentally, my last of a few species that I never saw elsewhere. On the morning of September 23 I left Venturi and went by the Central Cordoba Railway to Concepcion, province of Tucuman. Concepcion was my base from this time until December 23, just three months to a day. Here I was fortunate in obtaining the services of a peon stable-boy of Mr. Shipton's, one Pedro Carrero by name, who had assisted Mr. Shipton's collector, Juan Mogenson, and who knew the birds fairly well in an unscientific way. My work was further aided by Mr. Shipton who kindly gave me the use of horses and a two-wheeled buggy and also placed at my disposal a small brick hut. During the three months spent in this vicinity work was confined for the sake of exactness to a relatively small area between the Rio de Gastone and the sugar cane fields at La Corona, a plant of the Azucarera Argentina Company. A few side trips were made as follows: — Alpachirri, October 27; Ittico, November 20; and Monteagudo, November 25. The country around Concepcion is fairly flat, although only a few miles to the west rise the eastern Andes, culminating in the towering peak of Aconquija, over 20,000 feet in height. Where not under cultivation (sugar cane) the country is of an open savanna type abundantly dotted with Acacia trees and intersected, here and there, by small rivulets. The only sizeable stream in the near vicinity is the Rio de Gastone, about a hundred and fifty feet wide and shallow enough to cross in a buggy with the greatest of ease. The banks are sandy and devoid of vegetation, but this barren stretch is quite narrow, and arboreal vegetation is visible on both sides of the stream. There are several small marshy areas draining into the Rio de Gastone and on the edges of these marshes are dense thorny tangles and some real forest, forming a varied type of collecting ground. At Alpachirri and at the Rio Lules real subtropical forests are present in small, but truly magnificent patches, containing many very tall trees and great quantities of epiphytes and hanging vines.

On December 23 I left Concepcion by the Central Cordoba Railway for Buenos Aires, arriving there on Christmas morning. A week was spent in reoutfitting and in studying certain birds at the National Museum and on January 1 I left by Parana River steamer for Santa Elena, Entre Rios, whither I went on invitation from the officers of the Bovril Company, Ltd. About noon on January 3 the boat landed at the little pier at Santa Elena and I was met by Mr. C. H. Smyth and

Mr. A. Philip of the Bovril Company. For seven weeks, from January 3 to February 23, I remained at Santa Elena almost constantly, and worked under ideal conditions, the Bovril Company's officers having put at my disposal not only horses and peon assistants but even their two gasoline launches, and the Director, Mr. D. M. Frederick, insisted on my accepting his hospitality. To these gentlemen I am greatly indebted for a wonderfully pleasant and productive seven weeks. Mr. Smyth later sent me specimens of eggs that I required, and both he and Mr. Philip gave me much interesting and valuable information, still further increasing my indebtedness.

The country around Santa Elena is sandy and very broken and rugged, being merely a succession of barrancas overgrown with thorny bushes and dotted here and there with Acacia trees, while the monotony of the horizon is relieved by clumps of Eucalyptus trees wherever there are houses, chiefly ranchos. In the river Parana, just opposite to Santa Elena, is a long chain of islands, largely marshy in nature, but containing some fine patches of moist forest. These islands, recorded in this paper as the Bovril Islands or the Santa Elena Islands, are in the province of Santa Fe and were visited many times. One of them in particular, known as Deniz Island, was particularly rich in storks, herons, ibises, etc. Several trips were made to the Bovril Company's ranches, or as they are always called in Argentina, *estancias*, in eastern Santa Fe on the west bank of the river. This part of the country is a vast flat marsh with a few, but extensive, dry patches of higher land. Going across this level area on horseback from the Saladero M. Cabal on the bank of the river as far as La Noria, a good day's ride away, netted me many species not met with elsewhere.

On February 23 I left once more for Buenos Aires, my work on the cowbirds practically completed. I arrived in the Capital two days later and the next day wrote to the manager of the late Ernest Gibson's ranch for permission to conclude my field-studies in the same locality where the first careful work on the cowbirds had been done some fifty odd years before by Gibson. In the meantime the period of the Carnival intervened and as it was observed for a longer period by the American consulate than by the Argentine people themselves, my mail was considerably delayed. The most vexatious delay was with an invitation from Dr. Frank M. Chapman to join him on a trip to Chascomus. I received this note the day he returned to Buenos Aires from Chascomus, although the letter had been left at the consulate a week previously. Finally on March 8 I left by the Southern Railway for Dolores and thence by stage to General Lavalle and to the Gibson estancia

Los Yngleses at Ajo. Here I remained until the twelfth when I left by coach and train for Buenos Aires where I arrived on March 14. Three days later I sailed for New York on the S. S. VESTRIS. On the way north stops were made at Santos, Rio de Janeiro, Trinidad, and Barbadoes. On the eighth of April I was once more in New York.

ANNOTATED LIST OF THE BIRDS.

The collection on which this report is based is in the M. C. Z. and the systematic work was done there. I am greatly indebted to Mr. Outram Bangs and to Mr. James L. Peters for their unvarying kindness and for much advice and assistance.

RHEIDAE.

RHEA AMERICANA (Linné).

The Rhea was observed in partial captivity in several places: Santa Elena, Entre Rios; near Cordoba City, Cordoba; San Pablo, Tucuman; and La Noria, Santa Fe. One was seen from a train-window on the Central Argentine Railway early in the morning on September 20 in the southeastern part of the province of Santiago del Estero and, judging by the country surrounding, was probably a wild bird. In settled districts the Rhea is largely only a memory now, except on some of the huge holdings of some of the meat packing companies.

TINAMIDAE.

NOTHURA MACULOSA MACULOSA (Temminck).

M. C. Z. 96,889. Ad. ♀. Argentina: Santa Elena, Entre Rios. 8 January, 1924.

This specimen has the tips of the feathers of the crown, back, scapulars, and interscapulars more grayish and less rufescent than in two specimens from Concepcion del Uruguay, Entre Rios, in M. C. Z. This difference, however, may be seasonal as the Santa Elena bird is a summer specimen in fresh plumage while the two from Concepcion del Uruguay are autumn birds. Nevertheless it would be well for some one with ample material to compare *maculosa* and *nigroguttata* with regard to season as well as age. Wetmore (Bull. 133, U. S. N. M., 1926, p. 33) writes that an old skin from Corrientes (north of Entre Rios)

taken in late spring or early summer is somewhat different from both *maculosa* and *nigroguttata*. It would not be at all surprising for a sedentary species like the present to break up into a large number of races, but it would be of great interest biologically if these racial differences were found to have begun as seasonal ones and were perpetuated all the year round in localities where seasonal changes were ecologically less marked.

This little tinamou was observed very frequently around Santa Elena, Entre Rios, during January and February. It occurs in open grassy country and hides in the grass rather than under bushes or shrubs. I noticed this particularly one day in a grassy field edged with thorny bushes. The birds, of which several were flushed, never seemed to consider the bushes as a possible means of concealment. Individuals were not infrequently noted on the golf course on the Bovril Company's estate and one was killed by a driven ball while I was there. This tinamou runs like a quail (*Colinus virginianus*), giving a sweet, somewhat melancholy whistle as it runs. The flight is extremely rapid, but uneven, short periods of gliding with arched wings held motionless alternating with series of rapid wing-beats. When a bird rises close by the whirring noise is much louder than that made by a quail.

The bird collected was in breeding condition, the ovary being much enlarged. The stomach contained many small seeds, and some finely comminuted vegetable matter.

SPHENISCIDAE.

SPHENISCUS MAGELLANICUS (Forster).

The first penguins were seen from the steamer when off the coast of Uruguay on August 29. Five birds were then noted swimming around the ship. They sat very low in the water, and whenever a wave of any size came their way they invariably dived through it instead of riding it. The next day, on the La Plata River, several scattered groups and some single birds were observed.

COLYMBIDAE.

AECHMOPHORUS MAJOR (Boddaert).

This grebe was first noticed on August 30 off the mouth of the La Plata River when two in non-breeding plumage were seen near the steamer. The next day in the harbor of Buenos Aires a flock of twenty

was watched near the Lamport and Holt Company's dock in the north basin. Some were in full breeding plumage. Inasmuch as no specimens could be collected the identification rests chiefly on size, although a careful examination of specimens a few days later in the National Museum in Buenos Aires confirmed my identification.

This species seemed to sit higher in the water than do most grebes. Like the other members of the family they proved to be expert divers, diving without effort, or any apparent plunging.

DIOMEDEIDAE.

DIOMEDIA MELANOPHRIS Temminck.

From southern Brazil south to the mouth of the La Plata, August 26 to 30, the Black-browed Albatross was a constant and common follower of the steamer, often coming very close to pick up bits of garbage thrown overboard. When settling on the water they raise the wings and hold them vertically, until satisfied of their position on the waves, when they fold them, looking very much like great gulls.

A mixed company of albatrosses, shearwaters, and petrels illustrates very clearly the ecological value of size. The large albatrosses feed on the large morsels, the shearwaters on smaller bits, while the petrels take what the others leave and even glean a certain amount of the oily exudation of the garbage from the surface of the water. In this way nothing goes to waste for the larger birds would probably not heed the minute bits that interest the petrels. Of all the hundreds of these various birds that I watched feeding around the steamer none were observed to fight with individuals of other species over bits of food.

PROCELLARIIDAE.

PUFFINUS GRISEUS (Gmelin).

M. C. Z. 96,938. Ad. ♀. Uruguay: 10 miles off Cape Polonio. 30 August, 1923.

The single specimen collected flew on board the steamer and was caught by one of the stewards. The bird was very fat and in excellent condition. All the way from Rio de Janeiro southward to Buenos Aires these birds were very common, there being almost always anywhere from ten to a hundred of them around the ship. They sit rather high in the water and when rising they run with pattering feet for the first few wing-beats as though it were difficult to launch themselves into

flight. Although other seabirds, particularly *Daption capensis*, were common in the same place, the shearwaters kept in groups by themselves. The one collected vomited a yellowish oil when captured and bit my fingers savagely.

PROCELLARIA AEQUINOCTIALIS AEQUINOCTIALIS Linné.

These dusky birds were seen around the steamer in numbers from Brazil southward to Montevideo, August 25 to 30. They were fond of flying in circles around the boat, beating their wings only a few times and then sailing along with speed and grace. The yellowish color in the bill stands out in life against the otherwise uniform dusky aspect of the birds.

On August 25, when about thirty miles off the coast of Espirito Santo, one of these birds flew by the steamer, never rising more than a few feet from the water. It flew with long, easy wing-beats. Four days later, when off the coast of Rio Grande du Sol, there were about a hundred of them around the boat. That day we struck a heavy storm from the south which drove many subantarctic birds northwards and by the next morning the number of Procellarias had increased to several hundred.

DAPTION CAPENSIS (Linné).

Cape Pigeons, as these handsomely marked petrels are wrongly called, were first noted on August 25 when about thirty miles off the coast of Espirito Santo and some thirty miles from the Abrolhos Islands, when three birds appeared early in the morning and followed the steamer all day. That afternoon two more flew by. At 6 p.m. there were seven of them around the boat. None were noted for the next four days, but on August 29 when off the coast of Rio Grande du Sol ten were seen, and the next day, off the coast of Uruguay, about a hundred were observed following the steamer.

In flight the following marks stand out very distinctly: — the black heads and throats, white breasts and bellies, black wings with large white marks, the white and black vermiculated backs, black bills and feet. Few birds are more strikingly marked and my first impression of them was recorded in my field-book as "Flying Dominoes." They are to be ranked among the handsomest of all sea-birds and I doubt if any other bird ever gave me quite the thrill that the first *Daption* did.

They fly exceedingly gracefully, turning and wheeling sharply merely by inclining the body without flapping the wings. They fly

with alternate periods of flapping and soaring. When soaring on motionless wings, the wings are held in a strictly horizontal plane, not even slightly bent downwards as in most birds. Several times individuals were seen to plunge after food in a manner reminiscent of terns. They often rest on the water and were frequently seen riding the waves. When on the water they sit very high with the neck erect. No notes were heard from any bird.

Individuals are often caught with baited diamond-shaped pieces of tin or other bright metal thrown out on a string like a fish-hook, but although I tried this method no success attended my efforts.

OCEANITES sp.

On August 30 a small petrel, called by the sailors Mother Carey's Chicken, flew on board the steamer and was caught by one of the crew. Knowing the bird's fate if given to me, and influenced by their superstitious belief that to kill it would be to invite bad luck, they showed it to me and then let it go. It looked like the common Wilson's Petrel, *Oceanites oceanicus*, but I had a very imperfect view of it through the fingers of the hands that held it.

Wilson's Petrels accompanied the boat out of New York harbor on August 11 and were common all the way to Bermuda, August 13, after which no more were seen.

PHAETHONTIDAE.

PHAETHON LEPTURUS CATESBYI Brandt.

When about fifteen miles northwest of Bermuda, August 13, a Yellow-billed Tropic-bird flew around the steamer several times. Its flight seemed more like that of a gull than of a tern, but easily distinguished from that of either. It was more graceful and much swifter than that of a gull, yet the manner of flapping the wings was very larine. The wings did not have the angular bend so characteristic of terns. Four more birds were seen during the day around Bermuda.

SULIDAE.

SULA SULA (Linné).

Boobies were first noted off Cape Frio, Brazil, on August 26. On August 27 and 28 they were very common in the harbor of Rio de Janeiro. They flew rather low over the water and on many occasions

I saw seven or eight strung out in single file, giving the appearance at a distance of a flock of ducks, except that the wing-beat was gull-like. When resting on the waves boobies sat very low so that only a small part of the body showed above the water, agreeing in this respect with their relatives the cormorants.

PHALACROCORACIDAE.

PHALACROCORAX VIGUA VIGUA (Vieillot).

M. C. Z. 96,930. Ad. ♀. Argentina: Santa Elena Island, Santa Fe. 13 January, 1924.

M. C. Z. 96,931. Ad. ♂. Argentina: Santa Elena Island, Santa Fe. 12 January, 1924.

The Vigua Cormorant was very common along the Rio Parana, both on the Entre Rios side and on the Santa Fe shore, during my stay there in January and February. In the second week of March I saw a small group on the marshes of the Ajo River, Buenos Aires. One was seen near Ensenada, Buenos Aires, on September 10, and they were always to be found in the harbor of Buenos Aires City. A small flock was noted from the steamer near Montevideo on the morning of March 18 and was the last South American species observed. Cormorants, doubtless of this species, were noted in the harbor of Rio de Janeiro on the trip south on August 25, 1923, but not on the return voyage in 1924.

Single birds were frequently noted, but most of the birds were in flocks of from five to fifty, averaging about ten or twelve. In flight they resembled the Mexican Cormorant, except that they usually flew low over the water, all the members of a flock beating their wings in unison. The Mexican Cormorant (*P. v. mexicanus*) may also have this habit, but I never saw them fly this way and I have watched many of them in the lower gulf region of Texas. In the marshes of the Santa Elena Islands in the Parana almost every dead tree either supported one or more of these birds, or showed by a liberal spattering of excrement that it had been resorted to by the Viguas. There must have been thousands of them there, but well scattered over the place.

Both specimens collected had the gonads slightly enlarged and both had been feeding on small fish.

The iris in life is light, bright emerald-green.

ANHINGIDAE.

ANHINGA ANHINGA (Linné).

Water-turkeys were not uncommon on the Parana at Santa Elena during January and February. They mingled with the previous species and were never seen to fight with them. Locally this bird was known as Vigua Vibora or Snake Cormorant. I was told that a large full-grown Anhinga had been caught and eaten by a Caiman not long before my arrival. When swimming these birds sit very low in the water, sometimes almost entirely submerged save for the head and neck.

FREGATIDAE.

FREGATA AQUILA (Linné).

Frigate-birds were common in the harbor of Rio de Janeiro late in August. Most of them were seen soaring high overhead, but not a few were observed low over the water. When soaring the long tail-feathers are held parallel, but when wheeling or turning these feathers separate like the blades of a pair of scissors. While most of the Frigate-birds were soaring on motionless pinions a few were seen flying with regular, slow wing-beats. One bird was sailing over a small flock of Dominican gulls (*Larus dominicanus*) when one of the latter caught a fish; instantly the Frigate-bird closed its wings and shot down at the gull on the surface of the water and seized the fish as soon as it was dropped by the gull. On two occasions I saw Frigate-birds actually hit the water in these headlong plunges. This species was not noted south of Rio de Janeiro. About a quarter of the individuals seen were adult males with solid black bodies, the rest being females or young with whitish abdomens and breasts, and, in the case of the young, whitish heads.

ARDEIDAE.

NYCTICORAX NYCTICORAX NAEVIUS (Boddaert).

M. C. Z. 96,934. Im. ♂. Argentina: Bovril Islands, Santa Fe. 17 January, 1924.

I have not seen sufficient comparative material to form an opinion on the distinctness of the Argentine Night Heron. The form *tayuzugaira* is said to be characterized by the whiter belly and chin, but

Hartert, and, more recently, Wetmore (Bull. 133, U. S. N. M., 1926, p. 55) have considered it a synonym of *naevius*. I therefore follow them until more material is available. The only comparative material in the M. C. Z. is an immature bird collected by Barrows at Concepcion del Uruguay. The Santa Fe bird is lighter in general coloration, and much less streaked on the underparts.

Night Herons were very common in the islands in the Parana, opposite Santa Elena. Their habits seemed exactly like those of the North American bird.

The local names were Pajaro Bobo, Hoco, and Bruja.

BUTORIDES STRIATUS CYANURUS (Vieillot).

M. C. Z. 96,932. Ad. ♂. Argentina: Rio de Gastone, Tucuman. 11 December, 1923.

M. C. Z. 96,933. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 10 February, 1924.

The specimen from Tucuman has the brown throat and chest-markings considerably darker than the bird from Santa Fe. In Tucuman this species was fairly common in the marshy parts of the Rio de Gastone, but was not seen elsewhere in that province. In the Bovril Islands the birds were positively abundant. Their habits seemed no different from those of the Green Heron of the eastern United States.

Both birds collected were in breeding condition and both had been feeding on fish.

CASMERODIUS ALBUS EGRETTE (Gmelin).

M. C. Z. 96,935. Ad. ♀. Argentina: La Noria, Santa Fe. 21 January, 1924.

This egret was observed at the following places: — Alto Boa Vista (near Rio de Janeiro), Brazil, August 27; Berisso, Buenos Aires, September 6; Rio de Gastone, Tucuman, on and off during October, November and December; Bovril Islands, Santa Fe, January and February; San Joaquin, La Noria, and Saladero M. Cabal, Santa Fe, January 18 to 23.

In the extensive marshes and wet meadows of eastern Santa Fe these white herons were very common, often a hundred or more being in sight at a time. They were usually feeding in loose flock-formations or singly, never in compact masses like some of the ibises. At La Noria a few were noted with some cattle, but I doubt if this species has de-

veloped any such relation with quadrupeds as have the African cattle egrets, *Bubulcus ibis*. The general habits were the same as in the North American birds.

The local name for this species was Garza Blanca or White Heron.

ARDEA COCOI Linné.

The Ccoi Heron was fairly common in the Bovril Islands in the Parana during my visit in January and February, but no specimens were collected. It seems to take the place of the *Ardea herodias* of North America in Argentina, and acts and looks very much like it. Although most of the birds observed were single individuals, a flock of six was seen one day flying over at noon.

This species was called Garza Mora in Entre Rios and Santa Fe.

IXOBRYCHUS INVOLUCRIS (Vieillot).

On January 19 while going up the Caraya, a stream in the Bovril Islands, one of these little bitterns was flushed from the reeds and flew off a little way when it dropped back into the cover of the marsh. A little later another popped out, and with legs dangling awkwardly in the air, laboriously flapped away and disappeared in the reeds; in all, seven of them were seen, but it was impossible to collect any on account of the depth of the water which made wading out of the question and the density of the reeds which prohibited the passage of a rowboat. The birds reminded me greatly of the Least Bittern of the eastern United States (*Ixobrychus exilis*), but seemed somewhat more rufous.

CICONIIDAE.

MYCTERIA AMERICANA Linné.

M. C. Z. 96,937. Ad. ♂. Argentina: La Noria, Santa Fe. 21 January, 1924.

Wood ibises were noted at the following places: — one immature bird on the Rio de Gastone, Tucuman, September 30; common on the Bovril Islands, Santa Fe, during January and February; common at San Joaquin, and La Noria, Santa Fe, January 20 to 23; two on the Ajo River, Lavalle, Buenos Aires, March 10. In Santa Fe these birds were seen in company with egrets, maguari storks, and ibises, while on the

Ajo they were feeding with some Roseate Spoonbills. They were very wary and difficult to approach. The single specimen collected was shot as it flew over me.

The local names were Dorotea, Ciguena, and Tuyuyu.

EUXENURA GALATEA (Molina).

M. C. Z. 96,936. Ad. ♀. Argentina: La Noria, Santa Fe. 21 January, 1924.

The Maguari Stork was very common in the Bovril Islands in the Parana and in eastern Santa Fe (Saladero M. Cabal, San Joaquin, and La Noria). Several hundred were seen during two days at La Noria and San Joaquin, together with great hordes of other wading birds, egrets, wood ibises, glossy ibises, screamers, cocoi herons, and limpkins. A Maguari in flight is a very impressive bird, a massive bulk of contrasting black and white relieved at either end by a streak of red, the bill and feet being bright brick-red. At San Joaquin the marshes were literally dotted white with these great storks, but the birds were extremely shy. Only once did I see them perching on trees; in this case about twenty-five of them were clustered on a lone spreading, flat-topped tree making a sight not soon forgotten.

When captured young these birds soon become tame and several semicaptive birds were seen in parts of Santa Fe. They clap their bills with a loud clatter and in this way give notice of any new or suspicious arrival. In other ways too they seem quite capable of acting as watchdogs.

The specimen collected was no longer in breeding condition, and had apparently finished breeding at least a month before.

On September 12 at Berisso, Buenos Aires, three Maguaris were seen soaring high overhead. After a little while they began to flap their wings with a slow and steady rhythm and disappeared southward. Whether the birds were migrants or not it was impossible to tell.

THRESKIORNITHIDAE.

PHIMOSUS INFUSCATUS (Lichtenstein).

M. C. Z. 96,926. Ad. ♂. Argentina: Deniz Island (Bovril Islands), Santa Fe. 4 January, 1924.

This species was not nearly as common as the next, but was not rare in the islands in the Parana opposite Santa Elena. On January 4 a flock of seven was seen feeding on the edge of a little pond. The birds

stayed close together, but when I shot one the others flew off in two groups, four birds going one way and two another. The stomach of the bird collected contained some finely comminuted vegetable matter and a few pieces of gravel. In its general habits this species was similar to the next.

PLEGADIS GUARAUNA (Linné).

M. C. Z. 96,927. Ad. ♂. Argentina: Saladero M. Cabal, Santa Fe. 20 January, 1924.

The White-faced Glossy Ibis was noted sparingly along the Rio de Gastone, Tucuman, in November. In January and February it was very abundant in the Bovril Islands in the Parana and in eastern Santa Fe where countless thousands were observed. Single flocks of from 800 to 1,000 birds were often seen flying overhead at La Noria on January 21. In two days at this place and at San Joaquín over 15,000 were noted. The flocks when feeding always broke up into little groups of from two to twenty birds. At Lavalle, Buenos Aires, in March a flock of nine was seen on the Ajo River.

PLATALEIDAE.

AJAIA AJAJA (Linné).

Roseate Spoonbills were noted sparingly in Tucuman (Rio de Gastone) in November, and on the Ajo River, Buenos Aires, in March. In the Bovril Islands, Santa Fe, they were not uncommon, but very wary. Mr. Paul Haimes, an American resident in Concepcion, Tucuman, told me that in the extreme southern part of that province he had seen great flocks of these birds, containing many hundreds of individuals. In a little muddy tributary of the Ajo River I saw three spoonbills feeding on the shore. They fed with a sidewise motion of the head as though trying to strain the mud through the lateral lammellae of their bills. A little guttural croak was heard from one of the birds.

PHOENICOPTERIDAE.

PHOENICOPTERUS CHILENSIS Molina.

The Flamingo was noted but once — three birds on the shore of the Ajo River near Lavalle, Buenos Aires, March 10. They flew off while I was still some distance away.

ANHIMIDAE.

CHAUNA TORQUATA (Oken).

Ad. ♂. La Noria, Santa Fe. January 22, 1924. Coll. Cornell univ.

Crested Screamers were found in Tucuman, Santa Fe, Entre Rios, and Buenos Aires. Near Concepcion, Tucuman, a pair of these great birds were seen flying high overhead on October 24. As they flew they called *chaha, chaha*, with the accent on the second syllable, the notes, mellowed by distance, were, nevertheless, quite clear. These were the only ones seen during three months of field-work in that region, so they must be locally scarce. In the large islands in the Parana opposite Santa Elena, and in eastern Santa Fe (Saladero M. Cabal, San Joaquin, and La Noria) many pairs were observed during January and February. At Lavalle, Buenos Aires, and the near by Gibson estancia Los Yngleses, in March, I found screamers congregated in large flocks, feeding on the uplands among the sheep as wild geese often do. The largest single flock seen must have contained at least three hundred birds.

In the marshes of eastern Santa Fe screamers were extremely wary and it was only after a long and tedious hunt that I was able to procure a specimen. As soon as I came in sight of a pair, the birds would get restless, begin calling loudly, and long before I got within range would fly off. They were invariably in pairs, but when flying would separate temporarily and join again on landing. To look at one of these heavy, massive birds it would seem that flight would be difficult for them, but such is not the case. They are magnificent flyers and soar in upward-pointing spirals until, with all their huge bulk, they become mere animated dusky flecks in the bright sky. However, they seem to have a little trouble in rising. I once saw a pair standing in a wet meadow near a little pond, and as I came near them they raised their wings, slowly beat them forward and backward a couple of times, and then rose from the ground. As regards the wing-beat, their flight always seemed more heron-like than anserine, although their affinities are with the latter group. A few times I saw screamers perch on trees, but most of them were observed on the ground. They always stood with necks erect, and heads held high as though constantly surveying the surrounding expanse of marsh. The light cheeks, the black collar, and the crest were conspicuous at a distance.

At Lavalle, Buenos Aires, in March, screamers were in large flocks, but whenever a flock took to flight it broke up more or less into pairs. The birds were much less timid here than in the Bovril Islands.

In skinning the bird collected I found, as others have previously recorded, the skin completely underlaid with small air-sacs, which, when pressed, produced a distinct crackling sound. The intestinal caeca are peculiar, being stout and with many short, blind, pouch-like sacculae.

Screamers are often caught when young, and are domesticated as guardians of the poultry-yards by the peons. Armed with two very formidable pairs of spurs on the wings and with a voice that has the carrying power to reach both the intruder and the master at the same time, these birds are well adapted to this artificial duty. At the Saladero M. Cabal there was a half-grown one which had the spurs still poorly developed and which still had the piping voice of immaturity.

The common name for this bird all over Argentina is Chaja.

ANATIDAE.

CYGNUS MELANCORIPHUS (Molina).

The Black-necked Swan was a rare bird in my experience. Only a single specimen was seen. On March 10 in a little marshy tributary of the Ajo River, Buenos Aires, one was feeding in the shallow water. It tipped as its head went under, groping for food along the bottom just as with our tame mute swans in park lakes. As I approached the bird flew off. In rising from the water it made a great rushing sound as the wings beat the air, and the feet slapped the surface of the water. In the air it formed a very pleasing picture, the dark neck showing distinctly black against the rest of the body, which was sparkling white.

CAIRINA MOSCHATA (Linné).

Muscovy ducks were seen in small numbers on the Caraya during January and February. I never saw more than three together and usually met with single birds.

The local name is Pato Real.

DENDROCYGNA BICOLOR BICOLOR (Vieillot).

The Fulvous Tree-duck was fairly common in the Bovril Islands, where they were seen on and off during January and February. The largest flock seen contained eight birds.

The local name in this district was Siriri, doubtless an imitation of the call-note. Wetmore (Bull. 133, U. S. N. M., 1926, p. 72) writes that in

Paraguay this name is applied to *Dendrocygna viduata*. I did not see this species in the course of my work on the Parana, but was told of another tree-duck called Siriri Pampa, which probably refers to *viduata*.

NETTION BRAZILIENSE (Gmelin).

M. C. Z. 96,928. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 23 January, 1924.

Brazilian Teal were common in the Bovril Islands during January and February. In life the bill is unusual in color: a deep brownish purple on the maxilla and brownish red on the mandible. The birds seen were all in small flocks of from three to six, and kept close to the reedy shores of the streams where they fed on aquatic seeds and succulent water-plants.

The male collected had completed its moult.

The local name was Pato Salvador.

MARECA SIBILATRIX (Poppig).

These wigeon were common in the streams of the Bovril Islands, where they were seen in small flocks or singly throughout January and February. In their general habits they seemed similar to the North American *M. americana*. The white humeral patch is very diagnostic in recognizing these birds at a distance as they fly overhead.

CATHARTIDAE.

CORAGYPS URUBU FOETENS (Lichtenstein).

Black Vultures, probably of this species, were noted in great numbers in the harbor of Rio de Janeiro on August 27. They looked like the Black Vulture of the southern United States, had short tails, and did not soar well. All the birds seen had light spots on the underside of the basal parts of the primaries. They were particularly abundant at Pao de Assucar, Tijuca, and Corcovado. When going in the cable-suspended car from Uрга to the top of Pao de Assucar many of these birds flew close by, affording exceptionally good views. On the return trip in March they were seen again in Rio de Janeiro, but strangely enough, not in the harbor of Santos or in the highlands of Sao Paulo.

At Santa Elena, Entre Rios, and on the Santa Fe side of the Parana the Cuervos were abundant. In spite of their numbers I never saw one

on the ground, or in a tree during two months field-work. They were probably attracted by the killing and packing plant of the Bovril Company at Santa Elena, but I saw them only high up in the air.

VULTUR GRYPHUS Linné.

My field-acquaintance with the Condor was limited to a single bird seen soaring high overhead. On the morning of November 20 I went over the eastern Andes from Concepcion, Tucuman, into the eastern edge of Catamarca. While resting around noon at a vantage point in the road I focussed my camera on the snows of Aconquija and noted an image of a bird flying across the plate. Looking through my glasses I was delighted to see it resolve into a Condor. It soared around in a great circle and remained in view for about a quarter of an hour, when it disappeared around a bend in the valley.

FALCONIDAE.

MILVAGO CHIMANGO CHIMANGO (Vieillot).

M. C. Z. 96,918. Im.? ♀. Argentina: Ajo, Buenos Aires. 11 March, 1924.

My records for this species are: — Buenos Aires — Buenos Aires, Berisso, September 6, several; Dolores and Lavalle, March 8 to 11, common; Tucuman — Tucuman City, September 21, several; San Pablo and Rio Lules, September 22, several; Concepcion and Rio de Gastone, September 23 to December 23, common; Entre Rios — Santa Elena, January 3 to February 23, common; Santa Sofia and Viscacheros, January 27, common; Bovril Islands, San Joaquin, and La Noria, Santa Fe, January 19 to 23, common. Besides these records, Chimangos were noted from train-windows in the provinces of Cordoba, Santa Fe, Santiago del Estero, and western Buenos Aires.

These carrion hawks are abundant all over the open country, which in Argentina means practically everywhere. They go either singly or in small groups. In my experience they were in groups, chiefly toward the end of the summer and early autumn (February and March); in most cases these groups were probably composed of a single family. At Lavalle, Buenos Aires, I shot one out of a flock of nine; and here there must have been more than one family represented. Living in the open pampas where trees are few and far between, these hawks have become quite terrestrial and are expert runners and walkers. However, they seem to prefer elevated perches such as bushes, trees, etc., when-

ever they are available. For raptorial birds the Chimangos are surprisingly tame, but they are seldom molested as the peons do not often shoot them. In Tucuman I found small boys practicing their skill with slings on these birds. Although relatively undisturbed by man, they are much harrassed by other birds. Among the birds seen chasing the Chimangos were Lapwings (*Belonopterus chilensis lampronotus*), Guira Cuckoos (*Guira guira*), Fork-tailed Flycatchers (*Muscivora tyrannus*), and Cowbirds (*Molothrus bonariensis bonariensis*).

POLYBORUS PLANCUS PLANCUS (Miller).

Like the Chimango, the Carancho is abundantly distributed over Argentina. In the vicinity of the city of La Plata, Buenos Aires, they were fairly numerous on September 5; many were seen from the train-window in Buenos Aires, Santa Fe, and Santiago del Estero, September 20; Tucuman — Tucuman City, September 21, a few; San Pablo, September 22, two; Concepcion and Rio de Gastone, September 23 to December 23, common; Santa Elena — Entre Rios, January 3 to February 23, not uncommon; Bovril Islands, January 19 to 23, common; Saladero M. Cabal, San Joaquin, and La Noria, January and February, very abundant; Dolores and Lavalle, Buenos Aires, March 6 to 10, common.

Caracaras were usually very shy and difficult to approach. At Concepcion, one was seen perched in the top of a tall Eucalyptus tree near a poultry-yard day after day for over a week, but as far as I could find out it did not molest the poultry. According to the peons the Caranchos live mostly on carrion, but in Entre Rios I saw one pursue and kill a Guira Cuckoo. In all positions, on the wing or at rest, the Caranchos are strikingly marked birds and are easily identified far off.

One was observed sitting on its nest in the park July 9 in Tucuman City on September 22. The nest was a large structure made of twigs and was about thirty feet from the ground.

CERCHNEIS CINNAMOMINUS CINNAMOMINUS (Swainson).

M. C. Z. 96,910. Ad. ♂. Argentina: Santa Elena, Entre Rios. 7 January, 1924.

This sparrow hawk was noted a few times during October, November, and December at Concepcion, Tucuman. At Santa Elena, it was very common during January, and became less numerous around the middle of February. The flight and notes are the same as in the Sparrow Hawk of eastern North America. In Entre Rios these birds

were fond of perching on the telegraph wires and poles from which elevated positions they swept down on their prey. I saw one fly off with a Lenatero, *Anumbius anumbi*, and another pursue a Yellow-breasted Marsh-bird, *Pseudoleistes virescens*. They also fed on the locusts which were everywhere abundant, although the stomach of the single specimen collected contained only two lepidopterous larvae.

ELANUS LEUCURUS LEUCURUS (Vieillot).

M. C. Z. 96,911. Ad. ♀. Argentina: Concepcion, Tucuman. 3 October, 1923.

M. C. Z. 96,912. Ad. ♀. Argentina: Concepcion, Tucuman. 4 October, 1923.

The White Kite, or Halcon Blanco of the Argentinians, was observed only near Concepcion, where three were seen, two of which were collected. The first one seen (October 3) was pursued by a small group of cowbirds, *Molothrus bonariensis bonariensis*. The next day another was seen in a tree near the spot where the first one was collected. It had the remains of a mouse in its stomach, while the other one had been feeding on locusts. The third individual seen was soaring around in a wide circle over a large field of sugar cane. In the air this species at times looks almost like a gull.

One of the specimens is not quite adult and has many brownish flecks on the feathers. The iris in life is bright crimson with a slight suggestion of orange. Both ovaries are present, the right one being about a third as large as the left. Neither of the two birds collected were in breeding condition.

ROSTRHAMUS SOCIABILIS SOCIABILIS (Vieillot).

This race of the Everglade Kite is quite unusual in its habits in that it commonly occurs in flocks. On September 20, while going from Buenos Aires to Tucuman, I counted the individuals seen from the train-window and found the total for the day (provinces of Buenos Aires, Santa Fe, and Santiago del Estero) to be at least 1,500. Loose flocks of over 100 birds were frequent in marshy districts. In one place near Rosario I counted sixty-eight in four minutes. Fully adult birds in dark plumage comprised about 20% of the total number seen. As the train slowed up in one place I saw one of these birds sitting on what may have been its nest, a little raised mass of reeds and dead stems in an open watery part of the marsh.

Around Concepcion and Rio de Gastone these hawks were somewhat uncommon, doubtless because there were no extensive marshy

areas near by. In late December when passing through eastern Catamarca and Cordoba I noted many of these Gavilans. In the swampy islands of the Rio Parana opposite Santa Elena, Entre Rios, and in western Santa Fe (Saladero M. Cabal, San Joaquin, and La Noria) they were very numerous, but not exactly in flocks, scattered rather evenly about a pair per acre. During January and February they maintained this somewhat scattered arrangement, but were not breeding so far as I could find out. Towards the middle of February they became scarce. In this district the immature, and not fully adult birds, were called Caracolero, while the dark plumaged adults were known as Caracolero Negro, being considered by the peons as a distinct species. None were observed in March at Lavalle, Buenos Aires, but the peons there knew of the Caracolos and told me that they had all left in the beginning of February.

RUPORNIS MAGNIROSTRIS PUCHERANI (J. and E. Verreaux).

M. C. Z. 96,917. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 17 January, 1924.

This hawk was fairly common in the Bovril Islands in the Parana, where it was found chiefly in the more wooded parts. On a few occasions one was seen in open swampy places together with some of the preceding species.

The bird collected had been feeding on locusts.

Iris white; bill light bluish green; cere and feet yellow.

The local name was Gavilan.

RUPORNIS MAGNIROSTRIS SATURATA (Sclater and Salvin).

M. C. Z. 96,916. Ad. ♀. Argentina: Alpachirri, Tucuman. 27 October, 1923.

This race was noted only at Alpachirri, Tucuman, where several were seen on October 27. They were attracted by the noise of the Ford car I was travelling in, and came out of the thick forest to gaze at the origin of the strange noises. The only notes heard were shrill and drawn out. The stomach of the bird collected contained the remains of a mouse and three beetles.

Iris yellowish white; bill light bluish green; cere and feet yellow.

The Alpachirri skin is much darker generally than any specimen of any race of this species in the collection of the M. C. Z. The underparts excepting the throat are distinctly rufous. This is particularly true of the tibia and breast. The throat is black with some buffy

whitish streaks; the crown and sides of the head are black; no light streaks on the crown; under wing-coverts tinged with rufous chestnut. The bar-marks on the feathers of the belly are narrow and rusty chestnut in color.

PARABUTEO UNICINCTUS UNICINCTUS (Temminck).

M. C. Z. 96,919. Ad. ♀. Argentina: Concepcion, Tucuman. 12 October, 1923.

On October 12, one of the stable-boys at the Ingenio La Corona, near Concepcion, asked me to shoot a large Halcon that was sitting in a tall Eucalyptus tree near a poultry-yard. The bird when shot was found to be of the present species. In its stomach were the remains of three small birds.

During the next two months I saw several large hawks that may have been of this species, but they were too far away for certain identification. At Santa Elena, Entre Rios, and particularly in the Bovril Islands just opposite in the Parana, this species was observed several times during January and February. In this region it was called Gavilan.

The iris in life is light hazel-brown. Both ovaries are present.

ACCIPITER PILEATUS (Temminck).

M. C. Z. 96,913. Ad. ♀. Argentina: Concepcion, Tucuman. 15 October, 1923.

M. C. Z. 96,914. Im. ♀. Argentina: Concepcion, Tucuman. 7 October, 1923.

M. C. Z. 96,915. Ad. ♀. Argentina: Concepcion, Tucuman. 19 October, 1923.

This hawk was not uncommon in bushy or thinly forested country near Concepcion, Tucuman. Strangely enough I never saw the species in flight, but only perching on the topmost branches of thickly foliaged trees. Examination of the stomach-contents revealed the following: — in one were the wing-bones and some grayish feathers of at least two small birds; in another the remains of at least two mice; while the third contained a mass of small grayish feathers, the clavicles of a small bird, and a zygodactyl foot of a bird the size of *Colaptes campestris*.

In the two adults collected both ovaries were present and slightly enlarged. The left was in each case slightly more enlarged than the right.

In life the iris is bright orange-red and the cere light greenish.

RALLIDAE.

FULICA RUFIFRONS Philippi and Landbeck.

In the Bovril Islands in the Parana these coots were observed in flocks of *Fulica leucoptera*. They were not nearly as numerous as the latter, but were not uncommon. They were much shyer and stayed closer to cover.

Local names were Gallareta and Gallineta.

FULICA LEUCOPTERA Vieillot.

White-winged Coots were very common in the Bovril Islands, Rio Parana, and in the marshes of eastern Santa Fe (Saladero M. Cabal, San Joaquin, and La Noria), where they were observed throughout January and February. In March I saw a small flock, about a dozen birds, in a marshy affluent of the Rio Ajo at Lavallo, Buenos Aires.

In January, near the Saladero M. Cabal, Santa Fe, they were breeding; the nests resemble those of *Fulica americana*. One nest contained ten eggs, dull whitish in color, clouded with specks and small blotches of hazy purplish.

When rising from the water the pattering of the feet against the surface makes a considerable splashing noise and generally results in flushing all the individuals for some distance. I once saw a group of five rise from the water and before they were really well under way coots were springing up in all directions until about 200 birds were in the air. When flying the birds were silent, but when on the water or in the reeds they were incessantly clucking to each other.

ARAMIDES YPECAHA (Vieillot).

M. C. Z. 96,920. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

M. C. Z. 96,921. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 19 February, 1924.

Ypecaha Rails were very common in the marshes of the island in the Parana just opposite Santa Elena. They have the very unralline habit of roosting in trees; in fact the second one I collected was perched about fifty feet up in a Eucalyptus tree. Although the birds were common it was only on rare occasions that I was able to get a good view of one as they hid and skulked in the marshes like most rails. Once as I lay flat in a little boat I watched one of these handsome birds step out from a

mass of reeds and walk down to the water's edge and pick up a few morsels of food. The feet were lifted fairly high, the toes drooped as the feet came up and then straightened out again as the feet were lowered. The pace was very deliberate, yet it gave the impression of delicacy and caution. The head bobbed back and forth with each step and the tail flicked sideways as the bird walked. When perched in a tree they stood with the head brought back on the shoulders, but before flight, or in case of alarm the neck was stretched out and the head held high.

Hudson has described an elaborate courtship dance in this species. I never saw this, but on one occasion I saw an Ypecaha going through what may have been part of this dance. The bird was in a little clear spot in the swamp and pranced around for about thirty seconds with little change of position. The legs were brought up very high, the toes sometimes almost touching the body, and as the bird pranced the wings opened and closed more or less in time with the motion of the legs. The wings never opened more than half way. The neck was stretched, but not stiffly, and the head bobbed back and forth. A rather loud, harsh, wheezy call-note was uttered several times. Wetmore has described it as like the sound of a rusty windmill pump, which fits it quite well. Mr. Andrew Philip had several specimens in captivity at Santa Elena, but I never heard a sound from them.

The specimen collected on January 13 had a small mussel shell and some comminuted vegetable matter in its stomach, while the other bird had the claw of a crab, some small seeds, stones, and decomposed vegetable matter. The latter specimen is in worn plumage, and is noticeably paler than the bird taken a month earlier.

ARAMIDAE.

ARAMUS SCOLOPACEUS CARAU Vieillot.

M. C. Z. 96,929. Ad. ♂. Argentina: La Noria, Santa Fe. 21 January, 1924.

Limpkins, called Carau in Argentina, were very abundant in the extensive marshes of the Bovril Islands and in adjacent parts of eastern Santa Fe, San Joaquin and La Noria, during my visit in January and February. They are noisy birds, the call-note being a long drawn-out *carr-aaow*, in imitation of which the native name is doubtlessly intended. This note is usually repeated two or three times, but may also be given singly. Although true marsh-birds, nesting and feeding in the marshes, Limpkins are often seen perching in trees looking, at a distance, not

unlike dark-colored ibises. When startled into flight they seem to jump off clumsily from the perches and beat the air with their wings in rapid, but irregular, fashion, as though flying were not a common habit with them. In flight the necks are held straight out, as with cranes, and the legs dangle downwards. The flight is very diagnostic and serves to identify the birds as far as they may be seen. There is a little hesitant pause at the top of each stroke, the wings being held erect for a second before being brought down, and when once brought down to the bottom of the stroke they seem almost to snap back as though considerable strain were involved in maintaining the downward position.

Limpkins were still breeding in the Bovril Islands when I first arrived early in January, but they were late individuals. Most of them were apparently through rearing their young. I was shown some eggs by a peon, the eggs were blown and on a necklace, who told me he had collected them some few weeks previously. They were light grayish white, irregularly blotched with cloudy purplish and brownish. Eight to ten eggs comprise the average clutch.

At Lavalle, Buenos Aires, in early March, Limpkins were seen in small numbers in the marshes of the Ajo River.

CARIAMIDAE.

CHUNGA BURMEISTERI (Hartlaub).

At Monteagudo, Tucuman, one of these curious birds, locally known as Chuna, was seen running through the bushy, thinly forested plain and was soon lost to sight. According to the peons the Chuna can outrun a running horse, but this is probably an exaggeration. At most, the bird could maintain a fast pace for only a short time.

LARIDAE.

LARUS DOMINICANUS Lichtenstein.

The Dominican Gull looks like a small copy of a Black-backed Gull (*L. marinus*), not only in appearance, but also in habits. The species was first noted from the steamer off Cape Frio, Brazil, on August 26, when a flock of thirty hovered around the boat, feeding on bits of garbage thrown overboard. Their note seemed much clearer than that of *L. marinus* and was high, but not shrill, of a not unpleasant liquid

quality. In the harbor of Rio de Janeiro these birds were abundant and from there south to Buenos Aires the ship was never without an escort of these gulls. Apparently this species is confined to the ocean coasts as it was entirely absent on the Rio Parana and quite rare at Buenos Aires.

LARUS MACULIPENNIS Lichtenstein.

This species was common on the Parana at Santa Elena, associated with the Gray-headed Gulls, *L. cirrocephalus*. The two species could always be told by their call-notes, the present species having much shorter and more vehement notes, the latter more drawn-out and gentler. The flight of *maculipennis* is slower and more deliberate than that of *cirrocephalus*. The former bird seems less rigidly restricted to feeding over the water than does the latter. At least, I saw the Brown-headed Gulls flying over meadows a good deal and I notice that Wetmore (Bull. 133, U. S. N. M., 1926, p. 134) found them feeding on grasshoppers.

Two were seen at Ensenada, Buenos Aires, on September 10.

LARUS CIRROCEPHALUS Vieillot.

This species together with the preceding was almost always in evidence over the Parana at Santa Elena during January and February. As mentioned under *maculipennis*, the present species has a rather long drawn-out croaking call, very different from the short emphatic notes of the Brown-headed Gull. One was seen at Ensenada, Buenos Aires, September 10.

STERNA TRUDEAUI Audubon.

At Santa Elena, Entre Rios, this species was fairly common, but was much shyer than either of the other two species of terns found there, and no specimens were obtained. On the Parana they mingled with *Phactusa simplex chloropoda* and also with the Gray-headed Gulls, *Larus cirrocephalus*. According to information gleaned from local observers these terns breed during October and November. Once I saw a Trudeau's Tern pursuing a kingfisher, *Chloroceryle americana viridis*, attempting to rob it of a fish it held in its beak. Unfortunately the birds disappeared around a bend in the stream and I was unable to see the finish of this interesting episode.

STERNA SUPERCILIARIS Vieillot.

M. C. Z. 96,922. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 2 February, 1924.

These little terns were very common in the islands in the Parana just opposite Santa Elena. Flocks containing as many as several hundred birds were seen. With them were usually several of the much larger *Phaetusa simplex chloropoda* and, more rarely, *Sterna trudeaui*. This species is quite similar in its general habits to the Least Tern of North America.

The specimen collected is in fresh plumage; the crown is abundantly flecked with grayish white, the loreal stripe is merely a band of disconnected black spots, and the postorbital region is the only part of the head that is solid black. The testes were much enlarged; the bill and feet bright yellow. The stomach contained two small fish.

PHAETUSA SIMPLEX CHLOROPODA (Vieillot).

M. C. Z. 96,923. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 2 February, 1924.

M. C. Z. 96,924. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 2 February, 1924.

M. C. Z. 96,925. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 19 January, 1924.

This tern was very common along the Parana during my stay on that river (January and February) and was also noted on the La Plata from its mouth to Buenos Aires. It is a heavy-bodied species and looks much larger than it really is, especially when seen with more slenderly built terns of other species. I found it less common than the small *Sterna superciliaris*, but commoner than *Sterna trudeaui*. On a large sand-bar on the edge of the Caraya, a stream in the Bovril Islands, I once saw a flock of about 300 terns, mostly *Sterna superciliaris*, but containing about thirty of the present species. The former were less shy than the latter, and allowed much closer approach.

All three specimens collected had been feeding on fish. The bill and feet are bright yellow in life, the color being the same in immature and adult birds.

RYNCHOPIDAE.

RYNCHOPS INTERCEDENS Saunders.

Skimmers were not uncommon on the Parana near Santa Elena, Entre Rios, where they were observed on and off during January and February. They seemed to be more active around dusk than during the day, an observation also made by Darwin and by Hudson, but I know of no proof for the statement that these birds fish chiefly by night. They were very shy and no specimens were collected. They did not associate with the gulls and terns, but kept much to themselves. Most of the birds seen were single individuals, but small flocks were also noted. I saw one of them skimming along over the river with its lower mandible distally immersed, leaving a shallow furrow on the water in its wake. In their general habits the species is similar to *R. nigra* of North America.

JACANIDAE.

JACANA JACANA JACANA (Linné).

M. C. Z. 96,894. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 19 January, 1924.

M. C. Z. 96,895. Ad. ♂. Argentina: Concepcion, Tucuman. 29 September, 1923.

Jacanas were noted as follows: — Buenos Aires — Buenos Aires, Ensenada, Lavalle, March 6 to 10, a few; September 11, a few; near Rosario, Santa Fe (from train-window), September 20, common; Tucuman — Rio Lules, September 22, one; Concepcion and Rio de Gastone, September 23 to December 23, common; Bovril Islands, Rio Parana, and eastern Santa Fe (Saladero M. Cabal, San Joaquin, and La Noria), common during January and February.

Jacanas walk with a slow deliberate stride, placing one foot well down before raising the other. When walking about on lily pads and other floating vegetation the birds, while by no means inconspicuous, are not very noticeable; the brown color does not attract the eye of the observer very quickly. Every once in a while they raise their wings, showing the delicate green of the remiges that was hidden before. This flash of green is hardly to be called adaptive, although it simulates the broad, flat, green leaves of the aquatic plants among which the birds live. The mere motion of raising the wings is sufficient to destroy the protective quality of the color. The birds seem to have some difficulty in starting to fly as they run several steps, wildly waving their wings,

and meanwhile emitting a harsh, raucous, guttural screech somewhat like the sound of a distant burrowing owl, and then finally rise into the air. The flight is straight and rapid, with intervals of gliding interspersed between periods of rapid wing-beats.

A nest was found on October 4 in a marshy part of the Rio de Gastone; it was a floating structure made of dead stems and reeds and was placed on a little pile of similar reeds; the eggs, four in number, were pale tan in color, heavily spotted, and streaked with rufous brown, pointed at one end and round at the other. As I approached the nest (no bird was sitting at the time) one of the Jacanas flew up screaming loudly, fluttered around and then dropped down on a lily pad and, feigning a broken wing, half fluttered, half jumped from one leaf to another, trying to draw me away from the nest.

The body-fat in one of the birds collected was reddish orange in color. In life the bill was bright orange-yellow and the frontal shield soft and flexible and a delicate rose color.

Common names for this bird were Gallito (Tucuman and Entre Rios) and Cocha Polla (Tucuman).

HIMANTOPODIDAE.

HIMANTOPUS MELANURUS Vieillot.

Stilts were observed in the marshy areas of eastern Santa Fe (Saladero M. Cabal, San Joaquin and La Noria) and in the Bovril Islands in the Parana during January and February. In these places they were quite common and went by the name of Teru Real. They were often seen wading in the water nearly up to their bodies, but more often in shallower spots. They were very quick in their actions considering the length of leg immersed in the water. In flight they were extremely graceful. Their sharp yelps were similar to the notes of the North American *H. mexicanus*. Two were collected on January 20, but were too badly shot to be saved. Neither was in breeding condition.

SCOLOPACIDAE.

TRINGA SOLITARIA (Wilson) subsp.?

M. C. Z. 96,902. Ad. ♂. Argentina: Concepcion, Tucuman. 29 September, 1923.

I have not been able to satisfactorily determine the subspecific identity of the single specimen collected. This bird was seen only once

and I had, therefore, no chance of getting others. However Wetmore (Bull. 133, U. S. N. M., 1926, p. 148) found all his Argentine specimens of the Solitary Sandpiper to be the western form *cinnamomea*.

The bird collected was flushed from a little swampy part of the Chilimayo River, near Concepcion. It was the first North American migrant I met with in Argentina, but Wetmore records it as early as late August in Paraguay.

TOTANUS FLAVIPES (Gmelin).

M. C. Z. 96,901. Ad. ♀. Argentina: Saladero M. Cabal, Santa Fe. 20 January, 1924.

About a dozen Lesser Yellowlegs were seen together along the edge of a marshy stream near the Saladero M. Cabal, eastern Santa Fe, on January 20, and one of them was collected. It proved to be a female with the ovary very small. During the rest of the month and throughout February I came across individuals from time to time, but never saw them in flocks. They were very silent, not making a sound even when flying.

PISOBIA MELANOTUS (Vieillot).

M. C. Z. 96,903. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 19 January, 1924.

M. C. Z. 96,904. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 19 January, 1924.

Pectoral Sandpipers were noted not uncommonly in the Bovril Islands, Rio Parana, during January and February, but were never seen in large numbers. The two females collected were feeding at the waters' edge near a little pond, together with a few of the preceding species.

CAPELLA PARAGUAIAE (Vieillot).

This snipe was observed in small numbers in Tucuman and Santa Fe. On December 11 at Rio de Gastone, Tucuman, I saw several snipe, one which I collected was subsequently destroyed by rats. This species looks much like the Wilson's Snipe of North America, but makes a loud, reverberating, booming sound as it flies, the sound being a prolonged deep rumble increasing in volume as the bird comes near and decreasing as it flies away.

In the Bovril Islands, Rio Parana, in January and February, a few snipe, probably of this species, were noted.

The bird collected had been feeding on small worms.

In the former province it was called Carrero, while in the latter place the local name was Becasina.

CHARADRIIDAE.

CHARADRIUS COLLARIS Vieillot.

M. C. Z. 96,896. Ad. ♂. Argentina: Rio de Gastone, Tucuman. 21 November, 1923.

These little plover were fairly common along the sand-flats of the Rio de Gastone in November. Little groups of six or ten were often seen running along the edge of the receding wavelets in the same way as *C. semipalmatus* in North America. The notes were sharp and clear and may be written *psee*. A few were seen at Saladero M. Cabal, eastern Santa Fe, in January.

The local name was Chorlito.

PLUVIALIS DOMINICUS DOMINICUS (Müller).

M. C. Z. 96,897. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 19 January, 1924.

The specimen collected has the yellow margins of the feathers of the back unusually broad and bright.

I found the Golden Plover to be rather scarce but I was not looking particularly for shore birds. In addition to the one collected a few were seen during January and February.

BELONOPTERUS CHILENSIS LAMPRNOTUS (Wagler).

M. C. Z. 96,898. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 17 January, 1924.

M. C. Z. 96,899. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 17 January, 1924.

M. C. Z. 96,900. Ad. ♂. Argentina: Rio de Gastone, Tucuman. 7 December, 1923.

These large, handsome plover are exceedingly common in open country all over the northern half of Argentina, except in very dry regions. The local name Teru-Teru is an imitation of the call-note. It is one of the most persistent and characteristic sounds of the pampas. Bold, curious, aggressive, the Terus are birds of forceful personality and leave a striking image in the mind of the observer. Few birds are

more conspicuously or vividly marked either when at rest or on the wing. But birds like the Lapwing need no protection, in fact their very habits seem to scorn the idea. Always the noisiest bird in its locality, color would be of no use in concealing it. At a great distance, however, when only the back is visible, the Teru is not conspicuous. However, if we accept the birds' actions as a criterion of its coloration, the Teru knows it is conspicuous and in the nesting season will leave its nest and fly into space when the intruder is still so far off that he cannot see where the bird arose. For this reason their nests are hard to find. Unlike many conspicuously marked birds the Lapwing prefers fight to flight. Frequently I have had several of these birds dart close to me shrilly screaming *teru-teru* and threatening me with their spurred wings only to veer away suddenly and then return and repeat the performance. While riding across country on horseback I found I could come to within twenty-five feet of them before they would fly, but on foot such proximity is rarely attained.

Around Concepcion, Tucuman, the Terus were very local and were found only in the marshy areas of the Rio de Gastone. Many were seen at various times from train-windows in parts of the provinces of Buenos Aires, Santa Fe, Santiago del Estero, and Cordoba. In Entre Rios the species was totally absent in the immediate vicinity of Santa Elena, although abundant in the Bovril Islands in the Parana just opposite.

The birds collected had been feeding on small beetles and other insects.

COLUMBIDAE.

LEPTOTILA OCHROPTERA CHLORAUCHENIA Giglioli and Salvadori.

M. C. Z. 96,891. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

The single specimen collected is in badly worn plumage and shows relatively little iridescence on the mantle.

This pigeon, commonly known as Paloma de Monte was abundant at Santa Elena, Entre Rios, and also on the Bovril Islands in the river Parana just opposite. In the vicinity of Santa Elena it seemed confined to the wooded shores of the river and the more densely forested parts of the barrancas. It occupied the areas uninhabited by *Zenaida auriculata*, which it seemed to replace ecologically. In the islands where real forest was better developed the birds were commoner than on the

mainland, and were found in the same places as *Coccyzus capitata* and *Comptosia pitayumi*.

Not infrequently these birds were seen opening and closing their tails with a little twitching motion, exposing the white tips of the rectrices for an instant at a time. This is apparently not a courtship antic as the female collected was observed doing it.

The specimen collected was in breeding condition. The stomach and crop contained many small seeds and some comminuted vegetable matter.

COLUMBINA PICUI (Temminck).

M. C. Z. 96,890. Ad. ♀. Argentina: Santa Elena, Entre Rios. 10 January, 1924.

This little ground dove is one of the commonest birds in many parts of Argentina. It was observed at the following localities: — Buenos Aires — Buenos Aires, La Plata, Berisso, and Ensenada, September 3-17, common; Lavalle, March 6-9, common; Tucuman — Tucuman City, San Pablo, Concepcion, and Rio de Gastone, September 21 to December 23, common, seen daily; Santa Elena, Entre Rios, January 3 to February 22, common; La Noria, and Saladero M. Cabal, Santa Fe, common during January and February. In practically all these places the Palomita, as it is called by the people, is not only one of the most abundant birds, but also one of the tamest. In Concepcion, Tucuman, large numbers of Palomitas were always to be found around the stable-yards where, together with the cowbirds, they fed on seeds picked from horse dung or on cracked corn spilt from the troughs. Their monotonous cooing calls were kept up all day long without interruption, starting early in the morning and ending about 6 p.m. Probably in the winter months they are less vocally inclined. However during November and December the birds were tireless vocally.

In the immediate vicinity of Concepcion, twenty-three nests were found, the earliest on October 10, the latest on December 20. The nests, like most doves' nests, are very frail, being little more than a few small twigs and coarse grasses carelessly put together. One nest found on the upper surface of a palm-leaf, to which it was firmly attached by the dung of the parent bird, contained some cobwebs in addition to grasses and fine woody stems. I found nests as low as three feet from the ground and as high as sixteen feet above it. The first nest found (October 10) contained two young birds about a week old. The breeding season in Tucuman must therefore begin around the middle of September, if not earlier. The eggs, usually two in number (three in

one case), are pure white with a very slight gloss. They average 23 x 18 mm. (nineteen measured). The parent birds were usually rather shy near their nests, although not suspicious elsewhere. On one occasion I heard an incubating bird give a cooing call, but gave no particular thought to it at the time. However Wetmore (Bull. 133, U. S. N. M., 1926, p. 179) collected an incubating bird and found it to be a male.

Along in the second week in March, when I ended my field-work in Lavalley, a few birds were still cooing, although many full-grown young ones were everywhere in evidence.

The crop and stomach of the female collected contained an enormous number of small seeds, estimated roughly at not less than 5,000.

The white marks on the wings and tail serve as "flash" colors, as they are visible only in flight. When on the wing the birds are quite conspicuously marked, but at rest or when running about they are plain sandy in hue. They bob their heads like domestic pigeons when they run or walk.

ZENAIDA AURICULATA AURICULATA (Des Murs).

M. C. Z. 96,892. Ad. ♀. Argentina: San Sofia, Entre Rios. 26 January, 1924.

M. C. Z. 96,893. Ad. ♂. Argentina: San Sofia, Entre Rios. 26 January, 1924.

The two specimens collected are darker breasted than any others of the species in the collection of the M. C. Z.

This dove was very common in Entre Rios and was observed also in Buenos Aires, Santa Fe, Cordoba, Santiago del Estero, Tucuman, and near Montevideo, Uruguay. In the field they always seemed very much like the Mourning Dove and I notice that Wetmore (Bull. 133, U. S. N. M., 1926, p. 181) comments on this similarity in habits. Most of the birds were seen in pairs or groups of three to five, although at Lavalley, I saw a flock of sixteen on March 9.

Both specimens collected were in breeding condition and both had been feeding on small seeds.

CUCULIDAE.

CROTOPHAGA ANI Linné.

M. C. Z. 96,883. Ad. ♂. Argentina: Concepcion, Tucuman. 9 November, 1923.

In a wet meadow between Concepcion and the Rio de Gastone, Tucuman, a few Anis were seen, but they were very shy and wild. On November 9 a peon brought me a freshly killed bird in excellent

condition, which he claimed to have shot that morning. The testes were slightly enlarged, but the bird was not yet in breeding condition. The stomach contained some small beetles.

A few were seen in the Bovril Islands opposite Santa Elena, Entre Rios, in late January.

In Tucuman the common name was Pirincho Negro and in Entre Rios, Urraca Negro.

GUIRA GUIRA (Gmelin).

M. C. Z. 96,879. Ad. ♂. Argentina: Santa Elena, Entre Rios. 16 January, 1924.

M. C. Z. 96,880. Ad. ♂. Argentina: Concepcion, Tucuman. 16 October, 1923.

M. C. Z. 96,881. Ad. ♂. Argentina: Concepcion, Tucuman. 28 September, 1923.

M. C. Z. 96,882. Ad. ♀. Argentina: Concepcion, Tucuman. 28 September, 1923.

The Guira Cuckoo, or white Ani, was recorded as follows: — from a train-window provinces of Buenos Aires, Santa Fe, and Santiago del Estero, September 20, many; southern Tucuman, Catamarca, Cordoba, and Buenos Aires, numbers; Buenos Aires — Palermo, September 2, several; Quilmes, La Plata, Berisso, and Ensenada, September 6 to 10, common; Lavalle, March 10, several; Tucuman — Tucuman City, several in the parque 9 de Julio on September 21; San Pablo, September 22, several; Concepcion and Rio de Gastone, September 23 to December 23, common; Alpachirri, October 27, several; Itico, November 20, one seen; Entre Rios — Santa Elena, January and February, common; Quebracho, February 20, several; Saladero M. Cabal, Santa Fe, January 18, a few.

Guiras are birds of the thinly forested plains, usually in drier localities than those inhabited by their relative *Crotophaga ani*. The ecological habitats of the two genera (Guira and *Crotophaga*) show very clearly that each fills a separate niche in the general scheme of nature and that there could hardly be any competition between them. Guiras rest and roost in trees, but feed on the ground. Locusts, of which there are countless swarms, seem to constitute their main article of food. Several times, both in Tucuman and in Entre Rios, after invasions of locusts, I collected birds to see which species fed on these destructive insects, and each time the Guiras were found to consume more locusts than any other bird. Practically all the Guiras collected had locust remains in their stomachs.

Guiras have a great variety of notes, one set being like *kee-who-kee-kee-kee-kee-kee-kee-kow, kow, kow, kow*, the last four notes run together as in the notes of the *Coccyzus erythrophthalmus* of North America. Other notes are very harsh and nasal. One set of calls reminded me somewhat of the song of the Yellow-breasted Chat, *Icteria virens*; it may be written *peeow-peeow-wow!-peeow-pee-pee-pee-pee*, the last four being clear plaintive whistles like those with which the Chat sometimes ends its long and varied song. The alarm notes are harsh and strident. The birds seem to have some difficulty in controlling their tails which look excessively long. Every time a bird jumps from one branch to another the tail is violently jerked up and down, sideways, diagonally, and in every possible direction.

Guiras are always found in small flocks and they often roost in closely packed circles, all the birds facing outwards, their sides and backs touching, and their tails converging distally, giving the appearance at a distance of a huge, ragged, top-shaped mass with the apex downward. Such a group, when first seen, I took to be an old weather-beaten nest.

Considerable interest attaches to the nesting habits of the Guira because of its close relationship to the Ani, *Crotophaga ani*. However, so far as my experience goes (two nests), the Guira is monogamous. The first nest was in an Acacia tree near Concepcion, and was found on November 3. It contained six eggs of a beautiful greenish blue color, roughly scrawled and blotched with chalky white, the white flecks, deposited after the pigment, come off with handling. The eggs are elliptical, both ends being exactly alike. The nest was a crude structure of small twigs and was lined with green leaves, most of which were wilted and crushed in places. The other nest was found near the Rio de Gastone, Tucuman, November 21. It was built on a flat "leaf" of a large *Opuntia* cactus. Two Guiras were seen around it, but the nest was empty. It was apparently just finished as the lining of leaves was very fresh.

Guiras frequently eat eggs and young of other birds. I saw one go into a nest of a Bay-winged Cowbird, *Agelaioides badius*, and carry off a two-day-old screaming cowbird, *Molothrus rufo-axillaris*.

The iris is orange-red in life; the bare skin around the eye pale pea-green; the bill orange with a pinkish tinge.

In Tucuman this bird was called Pirincho and in Entre Rios Urraca, the last in Tucuman was applied to a jay, *Cyanocorax chrysops tucumanus*.

TAPERA NAEVIA CHOCHI (Vieillot).

M. C. Z. 96,884. Ad. ♀. Argentina: Concepcion, Tucuman. 12 November, 1923.

M. C. Z. 96,885. Ad. ♂. Argentina: Concepcion, Tucuman. 20 November, 1923.

This peculiar cuckoo, the only one in the western hemisphere known to be parasitic, was observed on a few occasions in the bushy thickets between Concepcion and the Rio de Gastone, during November. It is a shy bird and has considerable powers of ventriloquism which makes it a difficult species to observe. The first one collected was heard giving its two-syllabled call and the sound was followed for nearly half an hour before I caught a glimpse of the bird. It was perched in an Acacia tree, the posture being very erect for a cuckoo, and as it called, it raised and lowered its crest and swung its tail sideways like a pendulum. When it became aware of my proximity it suddenly cocked its tail and crouched as if to spring up into the air, but my shot ended its activities.

The egg is spotless white and is laid in the nests of several species of *Synallaxis*. In Argentina *S. spixi* is the commonest victim, but *S. cinnamomea russeola* and *S. superciliosa* are also parasitized. In Paraguay *Philydor rufus* is victimized to some extent. Usually but one of the parasitic eggs is laid in a nest, but two have been found in one nest of *S. spixi*. Data on some dozen victimized nests in Tucuman indicate that in that part of Argentina the breeding season of *Tapera* is in November and December.

The stomach-contents of the birds collected showed the food to consist of small beetles and lepidopterous larvae.

The local name, onomatopoeic in origin, is Crispin.

COCYZUS MELOCORYPHUS (Vieillot).

M. C. Z. 96,886. Ad. ♀. Argentina: Rio de Gastone, Tucuman. 21 November, 1923.

M. C. Z. 96,887. Ad. ♀. Argentina: Santa Elena, Entre Rios. 16 January, 1924.

M. C. Z. 96,888. Ad. ♂. Argentina: Concepcion, Tucuman. 9 November, 1923.

This cuckoo was seen several times in Tucuman and in Entre Rios. In life it greatly resembles *Coccyzus americanus* of North America. In Tucuman it was rather uncommon, only three birds being noted in as many months, while near Santa Elena it was fairly common in

the low, thick bush of the barrancas. In the latter place they fed largely on the locusts which swarmed abundantly there. In Tucuman their food was composed of caterpillars and small beetles. This species was never found in trees or on the ground, but only in low bushes, usually within four feet of the ground. In such places the birds flew among the closely intertwining branches with surprising ease and celerity. They were usually silent, but once I heard a low guttural *kuk* note.

On December 15 at Rio de Gastone, I found a nest, a flimsy, frail platform of twigs simliar to that built by *C. americanus*; it was about three and a half feet from the ground, and contained four eggs, one of which hatched as I watched it. The eggs were rather dull in finish and aquamarine in color. The nestling just hatched had snowy white trichoptiles, its skin was dusky orange, and the eye-skin dusky greenish gray. It gave a little shrill *peep* note. The gape was swollen and white. On January 8 at Santa Elena another nest was found. It was in a thorn bush a few feet from the ground; a third nest found near by on January 16, contained five eggs, an unusual number. Hudson writes that the normal clutch is three or four and that he never found more than four eggs in a nest.

In Entre Rios this species was known to the peons as Urraca Chica.

PSITTACIDAE.

CONURUS LEUCOPHTHALMUS (P. L. S. Müller).

M. C. Z. 96,851. Ad. ♂. Argentina: San Joaquin, Entre Rios. 27 January, 1924.

It seems that this parrot has not been hitherto recorded south of the Chaco (Ocampo and Mocovi) so that the present record extends its known range southward for over a hundred miles. The specimen collected has a much shorter culmen than four birds from eastern Brazil in the M. C. Z. The latter have culmens of from 28 to 29 mm., while the bird from Entre Rios has a culmen of but 25 mm. (measured from the cere). Specimens in the American museum of natural history from Misiones and from Salta agree with the Entre Rios specimen in having culmens 25 mm. in length. A specimen from Rio Cosireni, Peru, (U. S. N. M. 273,074) has a culmen of 31 mm. and has also an unusual amount of red on the malar region and the black shaft-streaks of the feathers of the underparts are very marked. It may belong to an undescribed race. Birds from Matto Grosso, Brazil, and from Paraguay

agree with those from Argentina. There is a good deal of variation in the length of wings and tail, which apparently has no geographical significance.

On January 27, at San Joaquin, one of the outlying estancias of the Bovril Company, I saw two *Conurus leucophthalmus* in a low tree. They were very shy, but I managed to obtain one of them. They flew down to the ground as if to feed, but quickly flew back to the tree as I came nearer. As they flew they gave a harsh, raucous screech. The testes of the bird collected were slightly enlarged.

MYIOPSITTA MONACHUS MONACHUS (Boddaert).

M. C. Z. 96,848. Ad. ♀. Argentina: Ajo, Buenos Aires. 10 March, 1924.

M. C. Z. 96,849. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

M. C. Z. 96,850. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

In the Bovril Islands opposite Santa Elena, Entre Rios, these parakeets were very common in flocks of from fifteen to fifty throughout my stay there in January and February. Flocks were also seen at La Noria and the Saladero M. Cabal, Santa Fe, and at Viscacheros, and San Sofia, Entre Rios. At the Saladero M. Cabal the children of Mr. Brown, the superintendent of the estancia, had two tame Monk Parakeets which climbed all over everyone and were very tame and affectionate. They never learned to talk or in any way modified the natural screech of their species. At Viscacheros a colony had its nest in a tall Eucalyptus tree right next to the ranch house and the birds although wild were quite used to people. The racket they made could be heard all through the house.

The nests, unusual for parrots, are huge colonial structures of twigs, looking much like gigantic synallaxine nests. Each pair of parakeets has its own private compartment, but the entire flock seem to be on intimate terms. Not infrequently other species, including the tree-ducks (*Dendrocygna*) occupy one or more of the nest-holes in these structures; and occasionally even some mammals such as the opossum take possession. The nest is used as sleeping quarters all the year round and is added to from year to year until at times it breaks the supporting branches by its weight.

Like all parrots, this species is very noisy. When one of a flock is shot the rest gather round screaming and screeching as if impelled by curiosity to disregard whatever fear they may have.

In southern Buenos Aires (near Lavalle) numbers of these Gray-

bellied Parakeets were seen daily. There was quite a sizeable colony of them at Ajo.

All the specimens collected had soft green leguminous seeds in their stomachs. The birds taken in Santa Fe on January 13 were in breeding condition, while the one collected at Ajo on March 10 was not.

In Buenos Aires this species went by the name of Loro, a name applied to all parrots, while in Entre Rios and Santa Fe the local name was Cotorra.

MYIOPSITTA MONACHUS CALITA (Jardine and Selby).

This race of the Monk Parakeet was seen at the Rio de Gastone, Tucuman, on several occasions during November and December. No nests were seen and the birds seemed to be wandering about aimlessly as I never found them twice in the same place on successive days. They frequented the fairly open Acacia-dotted plains east of the river and their harsh, noisy screams were often heard when the birds themselves were hidden by the trees. I assume the birds were of this race because *calita* was recorded by Hartert (Nov. zool., 1909, **16**, p. 234) at Rio Colorado, about fifty miles to the south. The birds flew swiftly with rather rapid wing-beats and usually did not rise more than thirty feet from the ground.

STRIGIDAE.

GLAUCIDIUM BRASILEANUM TUCUMANUM Chapman.

M. C. Z. 96,905. Ad. ♂. Argentina: Concepcion, Tucuman. 29 September, 1923.

On September 29 in a little forest near Concepcion, I saw two small owls sitting about ten feet apart high up in a tall tree. One was grayish and one rufous, but as only one was obtained I cannot say if they were a pair.

RHINOPTYNX MIDAS (Lichtenstein).

M. C. Z. 96,908. Ad. ♀. Argentina: Concepcion, Tucuman. 1 November, 1923.

M. C. Z. 96,909. Ad. ♀. Argentina: Concepcion, Tucuman. 23 November, 1923.

This owl, apparently unrecorded from western Argentina, was observed twice at Concepcion, during November, and each time the bird was quickly collected. This species perches in a very upright fashion in

thinly foliated trees in open country. One was seen in a tree beside a road at the Ingenio La Corona, a large sugar mill, where dozens of peons were continually passing.

Both birds collected had rodent bones and fur in their stomachs; some of the bones were large enough to be rat bones, but most of them were probably those of mice. Neither of the two birds were in breeding condition.

SPEOTYTO CUNICULARIA CUNICULARIA (Molina).

M. C. Z. 96,906. Ad. ♀. Argentina: Concepcion, Tucuman. 29 September, 1923.

M. C. Z. 96,907. Ad. ♂. Argentina: Santa Elena, Entre Rios. 9 January, 1924.

Burrowing owls were recorded as follows:—from a train-window, Buenos Aires, near Quilmes, September 6, several; from a train-window on the Central Argentine Railway between Buenos Aires and Tucuman, September 20, many; Tucuman—around Tucuman City, September 21, several; San Pablo, September 22, one; Concepcion and Rio de Gastone, September 23 to December 20, common; Alpachirri, October 27, several; Iltico, November 20, one; Entre Rios—around Santa Elena, February 23, common; Quebracho, February 20, a few; Santa Fe—Bovril Islands, Rio Parana; Saladero M. Calabal, January 20, one; La Noria, January 21, several; Buenos Aires—between Dolores and Lavalle, March 6–10, several.

On September 29 near Concepcion, an abandoned pasture, in which the earth had been bored into and raised in innumerable little mounds, was alive with Burrowing Owls, one or two sitting stiffly erect at the entrance of almost every burrow, their yellow eyes blinking solemnly as I approached. Some were perched in the trees, three in one small Acacia, two in another, while many trees had single birds. The birds were by no means shy and let me approach to about forty feet before flying. When a bird was finally frightened into flight it flew off about fifty feet and, landing with a few stiff-legged running steps, turned around and gazed reproachfully at the cause of its disturbance. The other owls did not fly off in unison, but each one or each pair flew off separately when approached. Their flight was always low over the ground, with rather slow, noiseless wing-beats. When excited, as on my approach, they uttered a harsh, piercing screech. This screech was always given three times in rapid succession. There must have been at least fifty pairs of owls in this field.

Some writers have claimed that the Burrowing Owl and the Vizcacha

(*Lagostomus trichodactylus*) live together in colonies. I saw hundreds of the birds and as many of the rodents, but never found them together. It may be that sometimes the owls use deserted burrows of the Vizcachas, but most of them certainly excavate their own tunnels. During November they were breeding in Tucuman and the entrances of all the occupied burrows examined were smaller than those of the Vizcacha holes.

During the great flights of locusts, which are such a great pest to the agriculturist everywhere in Argentina, the Burrowing Owl is of inestimable value as a check upon these insects. They gorge themselves with locusts; one of the birds collected had its stomach so full of them that they formed a solid, compact mass. The bird could not possibly have swallowed another one until those it already had were partly digested.

The burrows are diagonal, cylindrical shafts varying in length from five to ten feet, and terminate in a spherical compartment. In this compartment some dried dung, and bits of straw are laid as a carpet and on this are deposited the eggs. The eggs are pure white, although frequently soiled, and average 33×28 mm. (seventeen eggs measured). The largest egg seen was 35×30 mm. and the smallest measured 31.5×26.5 mm. The largest number I ever found in a nest was seven, although Serie and Smyth (El hornero, 1923, 3, p. 45) record as many as eight to a clutch.

The Burrowing Owl seems to be able to rotate its head to a greater extent than most birds. I once walked completely around one and it always faced me squarely turning its head as I went in a circle. It would be of interest to examine the atlas and axis of this species.

The male collected at Santa Elena had intestinal caeca measuring 52 and 58 mm., respectively, while its small intestine (pyloris to caeca) measured 254 mm. and the large intestine (caeca to anus) measured 43 mm.

The common name by which this bird is known in Argentina is Lechuza.

CAPRIMULGIDAE.

SETOPAGIS PARVULUS (Gould).

M. C. Z. 96,853. Ad. ♂. Argentina: Concepcion, Tucuman. 13 October, 1923.

A freshly killed specimen of this species was brought to me at Concepcion by a peon on October 13. It was a male in breeding condition, the testes being much enlarged. The stomach contained insect re-

mains. The iris was reddish brown with a dark blue pupil. The intestinal caeca were narrow and tubular and 16 mm. long; the small intestine was 58 mm. long, and the large intestine 13 mm.

PODAGER NACUNDA (Vieillot).

M. C. Z. 96,852. Ad. ♀. Argentina: Quebracho, Entre Rios. 20 February, 1924.

The single specimen collected has absolutely no white on the tail-feathers, agreeing in this respect with a female from Concepcion del Uruguay, Entre Rios, and with another from Quarahive, Uruguay, in the collection of the M. C. Z. However there is considerable variation in the amount of white in the rectrices of this species independent of sex, season, and locality, and apparently also of age. Some specimens in the series in the M. C. Z. have all but the central pair broadly tipped with white, the white area, in some, amounting to as much as a quarter of the whole feather in the outermost pair. The lower throat (immediately below the white patch) in the Argentine bird is very much more buffy, less barred with black, than in the M. C. Z. series of eight specimens.

My first meeting with the Nacunda, as this bird is called in the vernacular, was a memorable experience. On the morning of January 20 while riding across country from the Saladero M. Cabal towards La Noria, Santa Fe, with one companion, I dismounted to take a photograph. When setting up my tripod about a hundred feet from where I left my horse I flushed one of these nightjars. It flew only a short distance and settled in the grass. Going forward to where it disappeared I was startled to find that where one bird had gone down about two hundred flew up. Every step of mine flushed ten or a dozen. I ran back to my horse for the gun but was too late as the whole flock had gathered together in a loose, shifting group high up in the air and flew off across the lagoon.

Wetmore (Bull. 133, U. S. N. M., 1926, p. 205-206) writes that he found this species rather rare, and the largest flock he records contained only a dozen or so birds. This scarcity is probably true now for many parts of the country, but in eastern Santa Fe and northern Entre Rios the species is as common as it must have been when Hudson wrote of seeing it in great flocks.

The birds seem to see almost as well in daylight as at night, although they feed largely after dark. I frequently saw shadowy forms fluttering silently by in the dark along the roads around Santa Elena during

February. Most of these were probably this species. On the night of February 20 I went by car from Santa Elena to Quebracho; along the road numbers of *Nacundas* appeared in the lights of the car and one actually hit against the radiator and was collected. On the wing they seemed very heavy and stockily built for nightjars. The only note heard was a hiss from the bird captured after it dashed against the car.

The specimen collected was a female past the breeding season. Its stomach was greatly distended and very hard and contained twelve large locusts, three scarabaeid beetles, and eight other beetles.

ALCEDINIDAE.

MEGACERYLE TORQUATA CYANEA (Vieillot).

M. C. Z. 96,862. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 12 January, 1924.

These large kingfishers were very common along the streams in the Bovril Islands during my stay there in January and February. They were never seen in groups of more than two, and single birds were the rule. A curious thing about this species is that it always pumps its tail vertically three times before flying. Invariably as I approached one it pumped its tail once, then as I came nearer it did this a second time, and finally just before flying it did it a third time. I noticed this in a great many individuals and never knew it to vary. The flight is similar to that of *Ceryle alcyon* of North America, and so is its rattling call, but much louder. The stomach of the bird collected contained the remains of at least two small fish.

The Santa Fe specimen has heavier black shaft-streaks on the feathers of the crown and crest than a male from Concepcion del Uruguay in the M. C. Z. However the bird from eastern Entre Rios (Concepcion del Uruguay) is a spring bird (November 30), while that from western Entre Rios is a late summer bird (January 12). It may be that this difference in plumage is due to wear, but this is not likely.

The local name of this kingfisher was Martin Pescador Grande.

CHLOROCERYLE AMAZONA Latham.

M. C. Z. 96,863. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

This kingfisher was first seen flying along a little stream near Alpachirri, Tucuman, on October 27. One was seen late in November on the Rio de Gastone, Tucuman. In January and February many

were seen in the Bovril Islands, Rio Parana, where they were very common. In this locality the present species, while numerous, was not so abundant as the preceding species or the following one.

These birds were breeding in holes in banks about ten feet above the surface of the water, but by January most of them were through nesting.

In its general habits, flight, etc., the species is similar to *Ceryle alcyon*, but its rattle-call is shriller. The stomach of the bird collected contained fish-bones.

The local name, Martin Pescador, is applied to all kingfishers.

CHLOROCERYLE AMERICANA VIRIDIS (Vieillot).

M. C. Z. 96,864. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

M. C. Z. 96,865. Ad. ♂. Argentina: Alpachirri, Tucuman. 27 October, 1923.

M. C. Z. 96,866. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 17 February, 1924.

This little kingfisher was seen at Alpachirri, on October 27, where several were noted and one collected. It was not met with again until the following January when I found it abundant in the Bovril Islands in the Rio Parana. Throughout January and February it was seen in numbers every time I went to the islands, but I never observed it on the river itself or on the mainland either in Entre Rios or Santa Fe. Along the Caraya, a stream in the islands, all three species of kingfishers were very common. The present species seemed to be the fastest flyer of the three and was generally the most active, plunging after small fish, and hurrying up and down the stream. The three species evidently do not conflict or compete with each other, and form another illustration of the ecological significance of body-size already mentioned under the albatross, *Diomedea melanophris*.

This species was called Martin Pescador Chico in Entre Rios and Santa Fe.

BUCCONIDAE.

NYSTALUS MACULATUS STRIATIPECTUS (Sclater).

M. C. Z. 96,861. Ad. ♂. Argentina: Concepcion, Tucuman. 30 September, 1923.

This bucco was seen only near Concepcion and the Rio de Gastone, Tucuman, where it was not uncommon from late September until

the latter part of December. The first one seen was sitting in a tall bush with its head drawn down on its "shoulders" and the bill held about horizontal, looking very much like some of the small African kingfishers (*Halycon* sp.). The species was entirely silent in my experience. Usually it was stupidly tame and unsuspicious. I doubt if it ever makes long flights. I have seen one fly from one bush to another about twenty feet away and immediately assume its usual motionless, somnolent attitude. It can fly fairly quickly for such short distances, and probably swoops down from its perch on passing insects in the manner of the insectivorous kingfishers of the old world tropics.

The bill is bright orange-red in life.

They were known to the peons as *Durmi-durmi*, the name referring to their sleepy look.

PICIDAE.

PICUMNUS CIRRHATUS PILCOMAYENSIS Hargitt.

M. C. Z. 96,867. Ad. ♂? Argentina: Concepcion, Tucuman. 30 September, 1923.

M. C. Z. 96,868. Ad. ♂. Argentina: Concepcion, Tucuman. 12 October, 1923.

This piculet was observed only near Concepcion, where it was not uncommon in tangled thickets. The actions of this species are intermediate in character between those of miniature *Dryobates*-like woodpeckers and of Chickadees (*Penthestes atricapillus*). They peck on the small twigs of bushes and on bamboo (where this plant has been introduced) like miniature *Dryobates*, but have the pose of a *Penthestes*. The tail is usually free of the branch and is not used as a support. The birds cling to the undersides of twigs as easily as any woodpecker and travel downwards and backwards in little jerky hops as they work along a twig. The only note heard was a rather faint, lisping *tsip-tsip*. This note is easily overlooked and my attention was frequently aroused by the pecking noise, or by the flitting motion of the bird as it flew from one bush to another. The species stays low down never going, so far as my experience shows, more than about eight feet from the ground.

Both birds collected had been feeding on small black beetles.

DICTIOPICUS MIXTUS (Boddaert) subsp.?

M. C. Z. 96,869. Ad. ♀. Argentina: Concepcion, Tucuman. 12 November, 1923.

M. C. Z. 96,870. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 17 February, 1924.

The male from the Bovril Islands is somewhat intermediate between *mixtus* and *lignarius*. Unfortunately the entire crown and occiput are bare except for a few feathers on the posterolateral edges of the occiput. Consequently it is impossible to tell whether the red is confined to the sides of the head. In its measurements the specimen is nearer to *mixtus* than *lignarius*. I am not able to satisfy myself as to the subspecific identity of the female collected.

It seems not improbable that *mixtus* and *lignarius* are less distinct than usually thought.

Beetles and lepidopterous larvae were found in the stomachs.

PICULUS RUBIGINOSUS TUCUMANUS (Cabanis).

M. C. Z. 96,871. Ad. ♂. Argentina: Iltico, Tucuman. 20 November, 1923.

This species was observed only once, at Iltico, Tucuman, on November 20, where it was heard tapping on a tree in a dense part of the forest. Its stomach contained many white grubs, probably coleopterous larvae, and one small seed.

TRICHOPICUS CACTORUM (d'Orbigny).

M. C. Z. 96,872. Ad. ♂. Argentina: Deniz Island, Santa Fe. 4 January, 1924.

M. C. Z. 96,873. Ad. ♀. Argentina: Santa Elena, Entre Rios. 9 February, 1924.

This Yellow-throated Woodpecker was seen several times around Santa Elena and in the islands in the Parana just opposite. It frequented thinly wooded or open country and was always observed singly or in pairs. They climbed about like dryobatine woodpeckers, but their call-note was more like that of a White-breasted Nuthatch (*Sitta carolinensis*), very nasal and drawn out. The stomach of the male collected contained several small black beetles, while that of the female held two fruit-pits about the size of cherry-pits, the remains of some reddish fruit-pulp, and some beetle remains.

CHRYSOPTILUS MELANOLAÏMUS PERPLEXUS Cory.

M. C. Z. 96,874. Ad. ♂. Argentina: Deniz Island, Santa Fe. 4 January, 1924.

M. C. Z. 96,875. Ad. ♂. Argentina: Deniz Island, Santa Fe. 4 January, 1924.

In my opinion *perplexus* is a valid race and can be easily distinguished from typical *melanolaïmus* by the middle stripe of yellowish olive bordering the shaft on both webs on the under surface of the outer

rectrices. This stripe is lacking in western birds of the typical race. A specimen from Mendoza in the M. C. Z. is more or less intermediate, but nearer *melanolaimus* than *perplexus*. Other characters distinguishing these races are discussed by Wetmore (Bull. 133, U. S. N. M., 1926, p. 220).

The two specimens collected were the only ones observed. They were on the ground acting much like Flickers (*Colaptes auratus*), but were not definitely seen to probe in the earth for food. Small black beetles were found in the two stomachs.

COLAPTES CAMPESTROIDES (Malherbe).

M. C. Z. 96,876. Ad. ♂. Argentina: Santa Elena, Entre Rios. 18 February, 1924.

M. C. Z. 96,877. Ad. ♂. Argentina: Santa Elena, Entre Rios. 9 February, 1924.

M. C. Z. 96,878. Ad.? ♀? Argentina: Santa Elena, Entre Rios. 9 February, 1924.

The Pampas Flicker is very similar in habits to the North American *Colaptes auratus*. Especially in flight is this resemblance striking when the suddenly revealed white rump-patch and the undulating progression of the bird recall the North American species very vividly. The species probes in the ground for its food, but also obtains some of its diet from stumps, trees, and fence-posts. Two of the three specimens collected had dried mud on the tips of their bills. Ants were found to be the favorite food. Each of the three stomachs contained at least a hundred small black ants, while one contained a large number of white grubs in addition. The only note heard was a long, harsh *keough*, quite similar to that note in *C. auratus*.

The local name in Entre Rios was Carpintero, a name applied to all woodpeckers.

TROCHILIDAE.

CHLOROSTILBON AUREO-VENTRIS TUCUMANUS E. Simon.

M. C. Z. 96,854. Ad. ♂. Argentina: Concepcion, Tucuman. 10 October, 1923.

M. C. Z. 96,855. Ad. ♂. Argentina: Concepcion, Tucuman. 28 September, 1923.

This little green Picaflor was quite common around Concepcion and Rio de Gastone, Tucuman, during my stay (September 23 to December 23). During January and February I saw large numbers around

Santa Elena, Entre Rios. At San Pablo and the valley of the Rio Lules, Tucuman, September 22, it was seen frequenting the flowers of several species of *Eupatorium*. With it were associated numbers of the beautiful *Sappho sappho*. A nest with two young was found near Concepcion on November 27. The nest was like that of *Archilocus colubris* in size and structure, being a soft, felted shallow cylinder made of downy plant-fiber and soft bits of bark. It was placed on the top of a palm-leaf about a foot from the axil. The young were evidently just hatched, and looked like newly hatched *Archilocus colubris*.

The stomachs of the two birds collected contained small fragments of insect remains, some of which seemed to be pieces of the elytra of minute beetles.

SAPPHO SAPPHO (Lesson).

This beautiful humming bird was observed only at the Rio Lules in the eastern foothills of the Andes in Tucuman, on September 22. As I went up the steep trail through the densely forested slopes this little species flushed from among the *Eupatoriums* with astonishing frequency, rapidly flitting here and there, the long tail glowing and sparkling as the sunbeams played on it. A most striking bird to the eye, it was also heard more than all the other birds together on that day. Its rather unpleasant harsh *tscha-tscha* note is surprisingly loud for a bird of its kind. Only one female was seen while about seventy or eighty males were noted.

HELIOMASTER FURCIFER (Shaw).

- M. C. Z. 96,856. Ad. ♂. Argentina: Concepcion, Tucuman. 9 October, 1923.
M. C. Z. 96,857. Ad. ♂. Argentina: Concepcion, Tucuman. 29 September, 1923.
M. C. Z. 96,858. Ad. ♀. Argentina: Concepcion, Tucuman. 29 September, 1923.
M. C. Z. 96,859. Ad. ♀. Argentina: Santa Elena, Entre Rios. 16 January, 1924.
M. C. Z. 96,860. Im. ♂. Argentina: Santa Elena, Entre Rios. 8 February, 1924.

This striking little humming bird was not uncommon in bushy fields and fairly open thickets. It was observed at Concepcion and Rio de Gastone, Tucuman, from September through December, several; also, Tucuman — Alpachirri, October 27, several; Iltico, November 20, one; Entre Rios — around Santa Elena, January and February,

fairly numerous; near the Saladero M. Cabal, Santa Fe, January 20, one.

Its flight and general habits seemed similar to those of *Chlorostilbon aureoventris*, but the present species appeared to be more partial to the pinkish flowers of *Verbena chamaedryfolia* than to Eupatoriums. It was often seen perched on the telegraph-wires along the roadbed of the Central Cordoba Railway, the edges of which were literally carpeted with patches of the *Verbena*.

DENDROCOLAPTIDAE.

XIPHOCOLAPTES MAJOR MAJOR (Vieillot).

M. C. Z. 96,845. Ad. ♂. Argentina: Concepcion, Tucuman. 13 October, 1923.

The study-material available in the M. C. Z. consists of two females from Tapia, Tucuman (J. L. Peters), and two specimens from the Lafresnaye collection, including the type of *Dendrocolaptes rubiginosus*. These four and the Concepcion specimen exhibit considerable variation in the width of the white shaft-stripes on the breast. The two females from Tapia have these white stripes bordered with dark grayish brown; in some feathers the dark grayish is concentrated into small black dots. The male from Concepcion is larger than these two females as the following measurements indicate:—

Sex	Locality	Culmen from base	Wing	Tail	Tarsus
♂	Concepcion	56 mm.	157 mm.	118 mm.	31.5 mm.
♀	Tapia	50 mm.	152 mm.	121 mm.	30.0 mm.
♀	Tapia	51 mm.	140 mm.	118 mm.	29.0 mm.

The Carpintero Grande, as this large woodhewer was called in Tucuman, was a scarce bird in my experience. I saw but one, feeding on the ground like a Flicker, and as I approached it flew up into a tree and perched lengthwise, woodpecker-like, on a slanting branch.

The stomach contained ants and some unidentifiable insect remains. The iris in life was dark brown and the bill smoky blue-gray.

LEPIDOCOLAPTES ANGUSTIROSTRIS ANGUSTIROSTRIS (Vieillot).

M. C. Z. 96,846. Ad. ♂. Argentina: Concepcion, Tucuman. 17 November, 1923.

M. C. Z. 96,847. Ad. ♂. Argentina: Concepcion, Tucuman. 10 October, 1923.

There is considerable variation in size in this species. Besides the two birds from Concepcion, I have examined two males from Tapia, Tucuman (J. L. Peters), and find that the wing varies in males from 92 to 98 mm., the tarsus from 15 to 17 mm.; the tail from 68 to 82 mm.; and the culmen (from base) from 28 to 33 mm. Wetmore (Bull. 133, U. S. N. M., 1926, p. 236) records a male from Tapia with a culmen of 35.7 mm. and wings measuring 99.6 mm.

This species is one of the very few in my experience in which the size relations of the two testes vary individually. One bird had the left testis very large and the right one minute, while the other had them both very large and equal in size.

This woodhewer was not uncommon in the open, bushy Acacia savannas near Concepcion. It was often observed climbing up tree-trunks in true picine fashion, but with a jerky motion not usually noticeable in the more perfected climbing of the woodpeckers. Beetles were found in the stomachs of both birds collected.

In life the iris was dark brown.

DRYMORNIS BRIDGESI (Eyton).

M. C. Z. 96,842. Ad. ♀. Argentina: Santa Elena, Entre Rios. 4 February, 1924.

This species was observed but once and the specimen seen was promptly collected.

The series in the M. C. Z. shows great variation in size, the culmen varying from 59 to 69 mm., the wings from 131 to 140 mm.; the tail from 109 to 123 mm.; the tarsus from 29 to 31 mm. There is also considerable variation in the size of the white stripes on the underparts. The four birds from eastern Entre Rios (Concepcion del Uruguay) in the M. C. Z. have these stripes the smallest, while three from Tapia, Tucuman, have them best developed. The Santa Elena specimen is intermediate in this respect.

The stomach contained the remains of several locusts, a rather unusual choice of food for a tree-climber.

The iris was dark brown.

FURNARIIDAE.

FURNARIUS RUFUS RUFUS (Gmelin).

M. C. Z. 96,838. Ad. ♂. Argentina: Santa Elena, Entre Rios. 10 January, 1924.

M. C. Z. 96,839. Ad. ♂. Argentina: Santa Elena, Entre Rios. 10 January, 1924.

Ovenbirds were commonly observed everywhere in Argentina. They were numerous even in the parks in the city of Buenos Aires, as well as in La Plata, and were quite tame and accustomed to people. In Tucuman they were very common and large numbers of their nests were examined. The Tucuman birds may be referable to the race *commersoni*, but unfortunately no specimens were taken in that province. In western Argentina the bird was always called Hornero, while in eastern parts of the country two names, Hornero and Casero, were equally used.

The Hornero is one of the avian personalities of Argentina, and is one of the few birds universally regarded with friendly respect by the peons. The stories about it are numerous, one being to the effect that it never works on Sundays, but restricts its building activities to week days. In its general habits this ovenbird is somewhat like a thrush, feeding on the ground like a robin, and in flight resembles a large *Hylocichla*. When disturbed it is very vociferous, some of the loud, clear, ringing notes recalling the distress-call of the Robin (*Planesticus migratorius*). It both hops and runs, and on one occasion I saw an Hornero scratching among some dead leaves and stems with both feet simultaneously like a Fox Sparrow (*Passerella iliaca*).

The nest is a wonderfully well-built mud-oven with a spiral entrance on the side; it is straddled on horizontal or gently sloping branches of trees, or on the cross-bars of telegraph-poles, and even on fences and gates. In the great majority of nests found in the provinces of Buenos Aires and Entre Rios the entrance was on the left side, while in Tucuman, Santiago del Estero, and Cordoba, about as many nests had the entrances on the right side as on the left. Of approximately 600 nests observed, some 450 had the opening on the left.

I examined the contents of no less than 217 nests. Of these only sixty-one were occupied at the time by the ovenbirds while forty-nine were occupied by other species, *Machetornis rixosa*, *Sycalis pelzelni*, *Phacoprogne tapera*, etc. One contained seven little tree-frogs, *Hyla nasica*, and one egg of *Molothrus bonariensis*, while several nests, much to my discomfort, were inhabited by hornets.

The eggs of the Hornero are pure dull white and average (nine specimens) 30 x 21.5 mm. I never found more than five in a nest. This ovenbird is frequently parasitized by the cowbird, *Molothrus bonariensis*; eighteen out of sixty-one occupied nests contained one or more eggs of the parasite. Incredibly large numbers of cowbirds' eggs have been found in single nests of the Hornero — as many as thirty-seven in one case. The largest number I ever found was four. All nests in

which very large numbers of cowbird eggs are laid are usually deserted before many of the parasitic eggs are deposited, so that the number sat upon by the Hornero rarely exceeds four. The larger size of the ovenbird eggs does not seem to keep the *Molothrus* eggs from hatching first. I have never seen the young of the two species growing up together, but have found some nests containing young cowbirds and eggs of the ovenbirds and others with young ovenbirds and eggs of the cowbirds, but never any with young of both. I have, however, heard of one such case.

At Santa Elena, Entre Rios I was told by Mr. A. Philip, a thoroughly reliable observer, of a case where an ovenbird was watched for some days. Although it had two young of its own already out of the nest, it was seen to return to its nest with food for several days thereafter. Finally a young cowbird emerged from the nest and after that the old Hornero did not return to the nest.

Ants seem to be the main article of diet, at least both birds collected had nothing but ants in their stomachs.

One of the specimens collected, which may be not fully adult, has the feathers of the malar and gular regions terminally banded with grayish brown, giving the appearance of fine indistinct bars. These bars extend across the white throat.

FURNARIUS CRISTATUS Burmeister.

On an Acacia-dotted plain on the east bank of the Rio de Gastone, Tucuman, I saw several of these Crested Ovenbirds and found seven of their nests (November 24). In general this species acts and sounds much like the preceding one, but seems less terrestrial in its feeding habits. The nests are similar to those of *F. rufus*, but are smaller, not more than two thirds as large as those of the common ovenbird. One of the nests contained two eggs of the cowbird, *Molothrus bonariensis*, in addition to two of the builder. The eggs of the Crested Ovenbird are similar to those of *F. rufus*, but smaller, averaging 27 x 19 mm.

SYNALLAXIS SUPERCILIOSA Cabanis.

M. C. Z. 96,832. Ad. ♂. Argentina: Concepcion, Tucuman. 19 October, 1923.

I have had the opportunity of comparing the Concepcion specimen with but one other (M. C. Z. 94,797), a male from Sarmiento, Tucuman. The first is in worn, while the other is in fresh, plumage. In the fresh

plumage the crown and nape are brighter, lighter, and slightly more orange than in the worn plumage. In the former the tail is more rufous than in the latter and the secondaries are externally edged with rufous in the fresh plumage. These edges are entirely worn off in the Concepcion specimen.

Hellmayr (Cat. birds. Amer., 1925, p. 76) records measurements of five specimens of this bird, according to which the wings vary from 54-56 mm.; the tail from 86-91 mm.; the culmen is 12 mm. The specimen from Sarmiento in the M. C. Z. has the wing 61 mm., the tail 81 mm., and the culmen 10 mm.

In life the iris is bright coffee-brown, the bill blackish brown, and the feet dusky horn color. The stomach of the bird collected contained insect remains.

This species was quite common around Concepcion and Rio de Gastone, Tucuman, September 23 to December 23. Many of their huge stick-nests were seen and several in process of construction were observed. The birds were always seen in pairs.

The Bay-winged Cowbird, *Agelaioides badius badius*, often uses the nests of this *Synallaxis* to breed in and frequently usurps occupied nests after evicting the little spine-tails. On December 9, at Concepcion, Tucuman, I heard a commotion in one of the palm-trees along a little road and, on coming closer, saw a very spirited fight. A pair of Bay-wings were in the tree near a nest of this *Synallaxis*, and one of the spine-tails was also there. The Bay-wings were harshly chattering at the latter which kept up a loud, incessant alarm-call. Suddenly one of the Bay-wings flew directly at the *Synallaxis*, which then flew off hurriedly to the next palm. The Bay-wing pursued it and the two birds struck each other's bodies with a distinct thud. Fighting madly with wings and feet and screaming their loudest, the Cowbird harsh and guttural, the *Synallaxis* clear and ringing, they half fluttered, half dropped to the ground, where they fought desperately for a minute or so. Then the *Synallaxis* quickly flew off across the road and dropped down in a field of sugar cane. The Bay-wing was close behind and the fight was renewed for a few seconds, when the former flew off making a wide circle of the nesting tree. Five days later the Bay-wings were found in possession of the nest and there was no sign of the original owners.

The common name for this *Synallaxis* throughout Argentina is Leñatero.

SYNALLAXIS ALBESCENS ALBESCENS Temminck.

M. C. Z. 96,833. Ad. ♂. Argentina: Santa Elena, Entre Rios. 16 January, 1924.

In the M. C. Z. there is an immature female of this species from Tapia, Tucuman (J. L. Peters). It differs from the adults in that it lacks all but a trace of the rufous on the crown, the tail is darker and more rufous, and the back is more olive-brown and brighter than in the adult birds.

This spine-tail was quite common in the thorny thickets in the sandy barrancas in western Entre Rios where it was seen flitting around in the taller bushes and in the trees. No nests were observed that were definitely attributed to this species, but the bird collected was in breeding condition.

The common name is Leñatero.

CORYPHISTERA ALAUDINA ALAUDINA Burmeister.

M. C. Z. 96,843. Ad. ♂. Argentina: Santa Elena, Entre Rios, 15 January, 1924.

M. C. Z. 96,844. Ad. ♀. Argentina: Concepcion, Tucuman. 17 November, 1923.

These birds agree with a series of six from Tapia, Tucuman (J. L. Peters). Males are very slightly larger than females.

These pipit-like woodhewers were very common at Concepcion and Rio de Gastone, Tucuman, September 23 to December 23; at Santa Elena, January and February; and at Vizcacheros, Entre Rios, February 1. A few were noted around the city of La Plata on September 6. They are eminently terrestrial and go in small parties of six or seven (probably families), running about in the dry, open sandy places between thorn bushes. They show their arboreal phylogeny, however, at the slightest sign of danger when they take to the trees and taller bushes, where they hop and flit and clamber about with the greatest rapidity and ease. The alarm-call is a spluttering series of sharp clicks.

The nests are composed of sticks and twigs, and are very large for the size of the builders. Several nests were found, all of them empty.

ANUMBIUS ANUMBI (Vieillot).

M. C. Z. 96,834. Ad. ♂. Argentina: Santa Elena, Entre Rios. 15 February, 1924.

There is a good deal of variation in the markings of the breast in this species. In some birds (six specimens from General Lavalle, Buenos

Aires) there are distinct necklaces of black spots and the breasts are darkly streaked and quite distinct in shade and color from the lighter, more uniform bellies. Others (three specimens from Entre Rios and three from southern Brazil) lack the black necklaces and have the breast and bellies alike in color, fairly light, like the color of the bellies of the six specimens from General Lavalle, and more or less distinctly streaked.

Although most dendrocolaptids and furnariids are commonly called Leñateros in Argentina, the present species is the one most frequently meant when that name is used. I met it rather seldom considering its wide range and numerical status. In Tucuman I saw a few now and then from September through December near the Rio de Gastone. In western Entre Rios (vicinity of Santa Elena) the species was somewhat commoner and quite a number were seen during January and February. It frequents only dry Acacia savannas and thorny thickets, and each pair seems to require considerably more breeding territory than any species of *Synallaxis*. Near Santa Elena, a pair had a nest in a large Acacia, but the male usually perched near by on a post along a road. In flight the white in the tail shows very distinctly and serves to identify the bird, but when at rest the species is very inconspicuous and easily overlooked.

PHACELLODOMUS RUBER RUBER (Vieillot).

M. C. Z. 96,835. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

The single specimen collected agrees with others in the M. C. Z. from Paraguay and Bolivia. The species has not hitherto been recorded in northwestern Entre Rios and in as much as I saw but one during two months there, it is probably rare locally (*cf.* Serie y Smyth, *El hornero*, 1923, p. 37-55 for a list of birds of Santa Elena).

The stomach of the specimen collected contained ants and small beetles.

The iris was bright golden yellow.

PHACELLODOMUS RUFIFRONS SINCIPITALIA Cabanis.

M. C. Z. 96,836. Ad. ♀. Argentina: Concepcion, Tucuman. 30 September, 1923.

M. C. Z. 96,837. Ad. ♂. Argentina: Concepcion, Tucuman. 29 September, 1923.

Three birds collected in late autumn (April) at Tapia, Tucuman, by J. L. Peters, have the forehead and crown much darker and redder than

in the specimens I collected at Concepcion in the spring (September). The Red Thorn-bird is a denizen of the thickest thorny tangles and rarely exposes itself to view. It is an active, restless bird, constantly flitting and climbing among the small branches of tall bushes. This appearance of nervous activity is heightened by the jerky character of the gait. It has a sharp *chuck* or *check* note which it gives at frequent intervals, especially when alarmed.

PSEUDOSEISURA LOPHOTES (Reichenbach).

M. C. Z. 96,840. Ad. ♂. Argentina: Santa Elena, Entre Rios. 9 January, 1924.

M. C. Z. 96,841. Im.? ♂. Argentina: Santa Elena, Entre Rios. 10 January, 1924.

The only male specimen with which I have been able to compare the two Santa Elena birds is one collected by Barrows at Concepcion del Uruguay, eastern Entre Rios, January 27, 1880. This bird is much smaller in all its measurements than the two Santa Elena specimens from western Entre Rios and is much lighter and more rufous in color. However, considerable size-variation occurs in this species. The two Santa Elena birds differ in several respects from each other; a male (M. C. Z. 96,840) in breeding condition has the cheeks dark rufous and the rufous of the gular region is dark and extends over and includes the chin; the other male (M. C. Z. 96,841) in non-breeding condition (probably immature) has the cheeks brownish gray and the rufous patch on the throat is confined to the center of the throat, the chin and gular region being whitish. The rufous throat-patch is light, almost cinnamon in color. The belly and flanks in this bird are more rufous than in the other and the feathers of the breast and lower throat are terminally banded with grayish brown. In the breeding male there are none of these terminal bands save for faint indications on the lower breast.

The Cachalote, as this bird is called, was common in the dry Acacia-dotted barrancas and savannas of western Entre Rios. At Santa Elena (January and February) they were numerous and several of their enormous nests were found. The nests are compact, horizontal, roughly cylindrical masses of sticks and twigs and often attain a length of five feet and a diameter of two and a half or three feet. The entrance is round and just large enough to accommodate the entrance of the bird and is always at one end of the cylindrical nest. The eggs, usually three in number, are pure white and measure about 29 x 21 mm. (three specimens measured).

The flight of the Cacholote is rather slow and undulating, usually low over bushes and shrubs. Its usual call is noisy, being a loud crackling series of *cuk* notes all run together. The crest is quite noticeable in flight and is raised and lowered frequently. Perching birds also raise their crests when alarmed.

The iris in life is light brown.

FORMICARIIDAE.

TARABA MAJOR MAJOR (Vieillot).

M. C. Z. 96,830. Ad. ♀. Argentina: Concepcion, Tucuman. 7 October, 1923.

M. C. Z. 96,831. Ad. ♂. Argentina: Concepcion, Tucuman. 2 October, 1923.

These birds agree with three others from Tapia, Tucuman (J. L. Peters), in the M. C. Z. I have compared the Concepcion specimens with a series of thirteen from various parts of the range of the species and find no variation, except in the width of the bars of the outer tail-feathers. In some birds these feathers are more white than black while in others the preponderance of color is reversed. This variation is not geographical.

This species was met with somewhat sparingly in Tucuman during October and November. It was found only in low hedge-like thickets alongside paths and short, little-used roads. In such places this large ant-thrush scratches among the dead leaves for bits of food. The only birds seen attracted my attention by the noise they made in scratching among the leaves. The two collected had been feeding on small beetles.

The male has a very loud call, a clear, full, penetrating whistle rapidly repeated. It sings from the bushes, not from the ground.

TYRANNIDAE.

TAENIOPTERA CINEREA CINEREA (Vieillot).

M. C. Z. 96,796. Ad. ♂. Argentina: San Joaquin, Entre Rios. 27 January, 1924.

M. C. Z. 96,797. Ad. ♀. Argentina: San Joaquin, Entre Rios. 27 January, 1924.

The two specimens collected are in poor plumage making comparison with others difficult. Allowing for age and condition they agree with others in the M. C. Z. series.

I met with this strikingly marked flycatcher only at San Joaquin.

They were feeding on the ground when first seen, but flew up to an old post. They were very restless and constantly darted out after passing insects returning each time to the post. On the ground they walked and acted much like *Machetornis rixosa*. One of the birds had been feeding on small beetles, while the stomach of the other contained some locust remains.

Iris bright red; bill and feet black.

TAENIOPTERA IRUPERO (Vieillot).

M. C. Z. 96,798. Ad. ♀. Argentina: Concepcion, Tucuman. 2 November, 1923.

M. C. Z. 96,799. Ad. ♂. Argentina: Concepcion, Tucuman. 7 October, 1923.

The beautiful Viudita, as this bird is called, was common in open scrubby country wherever I went. It was recorded as follows: Concepcion and Rio de Gastone, Tucuman, September 23 to December 23, common in suitable localities; from train-window on the Central Cordoba Railway in the provinces of Cordoba and Buenos Aires, December 24, a few, in Entre Rios, Santa Elena, January 3 to February 23, common, and San Joaquin, January 27, one pair; La Noria, Santa Fe, January 19, one.

The pure white plumage of this species broken only by the black of the wings, coupled with its habit of perching quietly, almost motionless, for considerable periods of time, give the bird the appearance of a white flower or of a piece of cotton caught on the end of a tall cardon or other weed. It is extremely conspicuous and doubtless its habit of nesting in holes in trees is interrelated with its coloration. In my experience the species was very silent. Both birds collected had been feeding on small beetles.

LICHENOPS PERSPICILLATA PERSPICILLATA (Gmelin).

M. C. Z. 96,828. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

M. C. Z. 96,829. Im. ♀. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

The Pico de Plata or Silverbill was noted in many places in Argentina. It was first seen in the wet meadows at Berisso and Ensenada, Buenos Aires, early in September, where they were quite numerous. On September 20 I saw several from a train-window in parts of the provinces of Buenos Aires, Santa Fe, and Santiago del Estero. Several were seen in Tucuman at San Pablo, on September 22, and around

Concepcion and Rio de Gastone, it was very local and somewhat uncommon, September 23 to December 23. On December 23 several were noted from a train-window on the Central Cordoba Railway in the provinces of Cordoba and Buenos Aires. At Santa Elena, Entre Rios, it was locally absent on account of unsuitable ecological conditions, but in the Bovril Islands just opposite in the Rio Parana Silverbills were quite common. They were fairly abundant in eastern Santa Fe (Saladero M. Cabal, San Sofia, and La Noria) in January and February. Early in March several were noted at General Lavalle and Ajo, southern Buenos Aires.

Both birds collected were moulting heavily which makes comparisons useless.

This species is almost as restricted to the vicinity of water as is *Fluvicola albiventer*, but is frequently found in moist meadows while the latter is entirely a bird of stream-banks. In these marshy areas the little Silverbills are among the most conspicuous birds in regions where they are common. They fly low over the grass-tops and drop suddenly and vertically into the vegetation at the end of the flight. There seems to be no downward glide as in the flight of most birds. I never saw one perch in a tree or on any elevated perch so the species is probably wholly terrestrial.

The apparently bizarre coloration is very practical in the field. At a distance all the observer sees as the bird flies are the white wing-patches. The black color of the rest of the bird disappears, *i.e.*, it seems as though the observer looks right through it to the shadows on the grass. The white patches fluttering up and down in flight look like the disconnected wings of a butterfly. When close at hand the bird is conspicuous in flight, but as soon as it alights and folds its wings the white color disappears. It is an excellent example of a flash-color like the white rump of *Colaptes*.

This species is usually silent, but on a few occasions I heard a feeble, squeaky series of thin notes from adult males.

Four nests were found in the Bovril Islands during January; they are deep cups of dried grasses and resemble both in appearance and in site the nests of *Geothlypis trichas* of North America. All were in the bases of tussocks of swamp grass and were exceedingly well hidden. It was necessary to part the grasses to see the nests; all but one of them were empty as it was late in the season, but one contained four white eggs spotted and dotted with reddish brown, chiefly at the larger end. They measured 23 x 16.7 mm.

In life the bill and eye skin are light yellow, but appear white at a little distance.

MACHETORNIS RIXOSA RIXOSA (Vieillot).

M. C. Z. 96,810. Im. ♂. Argentina: Santa Elena, Entre Rios. 31 January, 1924.

M. C. Z. 96,811. Ad. ♀. Argentina: Concepcion, Tucuman. 27 September, 1923.

The specimens collected agree with a series in the M. C. Z. This fly-catcher was very common in all parts of Argentina visited. Around the city of Buenos Aires it was noted early in September; at La Plata, Berisso, and Ensenada, Buenos Aires, it was numerous during the second week of September, was very common around Concepcion and Rio de Gastone, Tucuman, September 23 to December 23, and was equally common at Santa Elena, Entre Rios, during January and February. A few were seen in eastern Santa Fe (Saladero M. Cabal, and La Noria) during January, and early in March a few were noted around Dolores, General Lavalle, and Ajo, Buenos Aires.

In Tucuman this species was called Matero and was very common around cattle and in the stable-yards where it walked and fed on the ground together with *Columbina picui* and *Molothrus bonariensis bonariensis*. Materos were often seen perched cowbird-fashion on the backs of horses and cows where they seemed perfectly at home and the beasts paid absolutely no attention to them.

In late September the Machetornis began to mate and thereafter was seen chiefly in pairs. The song is weak, thin, rather high, and is composed of four syllables of equal length and the same pitch. It sometimes breeds in old nests of ovenbirds and woodhewers, but frequently builds an open nest of straws, rootlets, and dead grass. In Tucuman I found ten occupied nests, the earliest on October 28 and the latest on December 16. Of these ten, five were old nests of *Synalaxis* sp., one was an old nest of *Furnarius rufus*, while four were open nests built by the tyrants. The last four were all in trees, the lowest being six feet from the ground, the highest about twenty feet up. The projecting base of an old leaf and the corresponding axillar cavity of a palm-tree was a favorite nesting site. Eggs of the cowbird, *Molothrus bonariensis bonariensis*, were found in three of the four open nests and in the old oven of *Furnarius*. None of the old synallaxine nests were invaded by the parasite. It is easier for a parasitic bird to deposit an egg in an open nest than in a domed one, so probably the pugnacity of the Machetornis is usually sufficient to keep the *Molothrus* out of nests of the latter type, while in open nests a few minutes off guard is enough to allow the parasite to lay its egg and get away. Three was the

largest number of cowbird eggs found in any nest of the Matero. The eggs of this tyrant are whitish, heavily streaked with brownish and grayish and are pointed at the small end. They average 22 x 17.5 mm. In a way they resemble the eggs of *Myiarchus crinitus* of North America.

FLUVICOLA ALBIVENTER (Spix).

M. C. Z. 96,800. Ad. ♂. Argentina: Concepcion, Tucuman. 12 November, 1923.

This dainty little flycatcher was observed as follows: Tucuman,—Rio de Gastone, September 23 to December 23, locally common; Concepcion, October and November, very local and uncommon; Bovril Islands, Rio Parana, Santa Fe, January and February, common. It is entirely restricted to the shores of streams or ponds. On the wooded edges of a little affluent of the Rio de Gastone, Fluvicola was quite common, flitting over the surface of the water after the manner of *Sayornis phoebe* of North America. This resemblance is restricted only to the flight of the two species. The present bird does not pump its tail vertically when perching. On December 11, at this place I found three nests. They were beautifully constructed purse-shaped affairs, made of dead grasses, fine straws, small rootlets and stems. All the nests were attached to the tips of branches overhanging the water. The entrance to the nest is on a side and the whole nest bears a general resemblance to that of *Telmatodytes palustris* of North America, but is slightly smaller and made of finer materials and more closely woven. The nests were all lined with feathers. One contained two eggs, one had a young bird, about eight or nine days old, and one was empty. The eggs are pure white with a few brownish flecks at the large end.

In the Bovril Islands in the Parana this bird was common in the reeds and rushes along the banks of streams. The eastern part of these islands are wooded and in the wooded portions of the streams this bird was absent. Five or six miles inland from the eastern shore of the islands the vegetation changes suddenly, the trees and shrubs disappear and in their place is a vast swamp of giant grasses and reeds. Here it is that this black and white tyrant makes its home. Its ceaseless activity, pursuing its insect prey in true flycatcher fashion, its dainty and distinctive coloring, and its strict adherence to one type of environment sharply demarcated from the rest of the island, make the bird unusually interesting and attractive in the field.

On January 12 while crossing the islands I found ten nests. Unlike those found in Tucuman, these were all vertically attached to the up-

right stalks of a tall plant called Cardon by the peons. (Cardon really means thistle which these plants certainly were not). In Tucuman this plant was not met with. The nests averaged about six or seven inches in height and three or four inches in width and were just like those found in western Argentina. Three of these nests contained three eggs each, four had two eggs apiece, one contained three young birds about four days old, and one was empty.

The specimen collected agrees with others in the M. C. Z. Its stomach contained insect remains.

SISOPYGIS ICTEROPHRYS (Vieillot).

M. C. Z. 96,816. Ad. ♂. Argentina: Santa Elena, Entre Rios. 9 February, 1924.

The single specimen collected agrees with others in the M. C. Z.

The Amarillo or Yellow-browed Tyrant was first observed at Concepcion, Tucuman, where a few were noted during October, November, and December. They were far from common, however. At Santa Elena, Entre Rios, this species was met with but once, a male seen and collected on February 9.

On November 12 near Concepcion, Tucuman, I found a nest; it was in a crotch in a thorn tree and about ten feet from the ground. The nest was a shallow cup about six inches in diameter (outside measurements) and about two inches deep and was made of fine twigs and rootlets and lined with a few feathers and some dead grass. It contained four eggs, very pointed at the small end, light buffy white in color with several blotches of rufous brown at the large end. Around the nest the parent birds were very shy.

KNIPOLEGUS ATERRIMUS ATERRIMUS Kaup.

M. C. Z. 96,827. Ad. ♂. Argentina: Concepcion, Tucuman. 9 October, 1923.

The specimen collected was the only individual of this species seen. It was in a dense thicket of thorn trees and flew from one tree to another, jerking its tail as it lit on a branch. The specimen agrees with others in the M. C. Z.

EUSCARTHMORNIS MARGARITACEIVENTER MARGARITACEIVENTER (d'Orbigny and Lafresnaye).

M. C. Z. 96,826. Ad. ♂. Argentina: Concepcion, Tucuman. 6 October, 1923.

An inhabitant of the brush and low thickets on the periphery of wooded areas, this species feeds on small insects, combining in its

feeding habits the aerial tactics of the true flycatchers and the terrestrial and arboreal gleaning method of vireos and warblers.

The specimen collected agrees with others in the M. C. Z.

SERPOPHAGA SUBCRISTATA MUNDA Berlepsch.

M. C. Z. 96,822. Ad. ♀. Argentina: Concepcion, Tucuman. 29 September, 1923.

The specimen collected differs from two from Mendoza (J. L. Peters) in the M. C. Z. in that it has almost no yellowish on the belly and under tail-coverts while both Mendoza birds are distinctly tinged with light yellowish. The two latter are intermediate between *munda* and typical *subcristata*, nearer to the latter if anything; they do not seem to be immature. Wetmore (Bull. 133, U. S. N. M., 1926, p. 320) writes that in immature birds in first winter plumage the lower abdomen is very faintly washed with yellow, suggesting the condition found in *subcristata*, but lighter and more restricted in extent.

Iris dark brown; bill and feet black.

SERPOPHAGA NIGRICANS (Vieillot).

M. C. Z. 96,823. Ad. ♀. Argentina: Concepcion, Tucuman. 2 October, 1923.

I have compared this specimen with others from Tucuman and Entre Rios and find no differences.

This is a nervous, restless little flycatcher and always reminded me of a gnatcatcher (*Polioptila*). They jerk their tails when hopping about in the branches and open and close them like a fan.

ELAENIA ALBICEPS ALBICEPS (d'Orbigny and Lafresnaye).

M. C. Z. 96,819. Ad. ♀. Argentina: Concepcion, Tucuman. 30 September, 1923.

M. C. Z. 96,820. Ad. ♂. Argentina: Concepcion, Tucuman. 9 October, 1923.

M. C. Z. 96,821. Ad. ♂. Argentina: Rio de Gastone, Tucuman. 4 December, 1923.

I have compared these specimens with a series of twenty-two from various parts of Argentina and find there is considerable variation in the amount of yellowish green on the flanks and bellies of the females. The males are more constant in this respect. In some females the flanks and lower abdomen are very grayish, only slightly tinged with yellow, while in others they are light greenish yellow with no indication of

gray. This variation is apparently not one of age and certainly is of no geographic significance, as both types occur together all over the range of the race.

This flycatcher was common around Concepcion and Rio de Gastone Tucuman, September 23 to December 23. It was found in scrubby, thorny patches and being shy and nervous it was rather hard to collect. On one occasion I saw one elevate its crown-feathers and expose the white median stripe for an instant.

SUIRIRI SUIRIRI (Vieillot).

M. C. Z. 96,815. Ad. ♀. Argentina: Santa Elena, Entre Rios. 9 February, 1924.

The specimen collected was moulting at the time, especially in the tail. Otherwise, allowing for sexual difference, it agrees with a series from Concepcion del Uruguay, Entre Rios, in the M. C. Z.

This species somewhat resembles the preceding one in life, but is less shy and is found in more open tree-dotted savannas. On November 29 at Rio de Gastone, Tucuman, I found a nest. It was a well-built cup of fine grasses, moss, and plant-fibers felted together and was placed in a little horizontal crotch in an Acacia tree about eight feet from the ground. It contained three eggs of the flycatcher and one of the cowbird, *Molothrus bonariensis bonariensis*. The eggs of *Suiriri suiriri* are pale creamy white, flecked and dotted with reddish brown and pointed at the small end.

The female collected at Santa Elena, Entre Rios, is apparently the first record for that district, as Serie and Smyth (El hornero, 1923, 3, p. 37-56) do not mention it in their list.

PITANGUS SULPHURATUS BOLIVIANUS (Lafresnaye).

M. C. Z. 96,808. Ad. ♂. Argentina: Concepcion, Tucuman. 3 October, 1923.

M. C. Z. 96,809. Im. ♂. Argentina: Santa Elena, Entre Rios. 8 February, 1924.

The Bienteveo, as this handsome tyrant is called, was one of the commonest birds everywhere in Argentina. It was recorded as follows:—Montevideo, Uruguay, August 31, several; seen from train-windows in provinces of Buenos Aires, Santa Fe, and Santiago del Estero, September 21, many; in provinces of Tucuman, Catamarca, Cordoba, and Buenos Aires, December 23, 24, many; Buenos Aires—Buenos Aires City, September 1 to 20, common in parks; La Plata, Ber-

isso, Ensenada, September 6 to 10, common; Dolores General Lavalle, and Ajo, early in March, common; Tucuman — San Pablo and Rio Lules, September 22, common; Concepcion and Rio de Gastone, September 23 to December 23, very common; Alpachirri, October 27, several; Iltico, November 20, several; at Santa Elena, Entre Rios, and the Bovril Islands in the Parana, Santa Fe, January 3 to February 23, common; Saladero M. Cabal and La Noria, Santa Fe, January 19, several.

The Bienteveo is one of the most characteristic birds of Argentina and is one that is commonly found around human habitations. In the garden of Mr. Stewart Shipton at the Ingenio La Corona near Concepcion, Tucuman, I have seen this bird feeding on insects close to the house. In stable-yards it sometimes gleans a few flies and wasps, but it is most numerous around water. Like its Mexican subspecies, the so-called Derby Flycatcher, *P. s. derbianus*, it makes a large, untidy, domed nest with an entrance on one side and rather high up. The nest is composed of fluffy vegetable — fibers, woolly material, string, and feathers and averages about a foot in height and seven inches in width. No attempt is made to conceal the nest or simulate its surroundings. When building the birds are said to steal whole nests of smaller birds to use them as building material in the construction of their own nests. Of five nests examined, two contained five eggs each, one contained four eggs, and two were empty. The eggs average 30 x 21 mm. and are light buffy white, with scrawls and specks of blackish or blackish brown on the large end. Fully fledged young were seen flying around as early as the middle of November. The young birds have a harsh, beady call that may be written *dzeeer*.

The call-notes of the adults are varied. Some notes are harsh and grating while others are clear, loud, and ringing. The vernacular name, Bienteveo, is an imitation of the commonest type of call-note.

The female collected on October 9 had an egg ready for the shell in its oviduct.

MYIODYNASTES SOLITARIUS (Vieillot).

M. C. Z. 96,806. Ad. ♂. Argentina: Concepcion, Tucuman. 10 October, 1923.
M. C. Z. 96,807. Ad. ♂. Argentina: Concepcion, Tucuman. 10 October, 1923.

The two males collected agree with a series in the M. C. Z.

This species was found only at Concepcion, where it occurred in the thickets and tall bushes around wooded areas. It was suspicious and shy, retreating into the protective cover of the bushy tangles at the first sign of danger. I found three nests of this bird: — two were in

horizontal crotches of thorn trees; while one was built in a tangle of vines overgrowing a dead bush. This last nest, found on December 19, contained two eggs of the cowbird, *Molothrus bonariensis bonariensis*, in addition to one of the tyrant. The nest is a rather shallow bowl of small twigs, stems, and straws with a lining of smaller straws and measures (average of three nests) seven inches across. The eggs are pointed at one end, are pale cream in color, streaked and spotted with reddish purplish brown.

MYIOPHOBUS FASCIATUS FLAMMICEPS (Temminck).

M. C. Z. 96,824. Ad. ♀. Argentina: Concepcion, Tucuman. 7 October, 1923.
M. C. Z. 96,825. Ad. ♂? Argentina: Concepcion, Tucuman. 30 September, 1923.

My two birds have wings of 63 (♀) and 64 (♂) mm., respectively while three unsexed birds from Bahia, Brazil, have wings of from 53–57 mm., three males from Colombia 57–59 mm., five females from Colombia 56–57.5 mm., two males from Venezuela have wings of 57.5 mm., and two unsexed birds from Trinidad 59 and 59.5 mm. respectively. These data together with those given by Wetmore indicate pretty clearly the subspecific distinctness of the birds of southern South America.

These little brown tyrants are inhabitants of low bushes and thickets along the banks of streams and roadsides. In their general actions they are not unlike small emipidonaxine species, but their nests are vireo-like, being deep cups suspended from two bifurcations of a terminal fork of a branch. I found two nests, the first on November 22 and the other on December 1, both near Concepcion. The first nest was about four feet from the ground and contained an egg of the cowbird, *Molothrus bonariensis bonariensis*, in addition to one of the flycatchers. The female bird was flushed from the nest and had apparently been incubating for some days. The next day the eggs were found pecked and the contents drunk and the nest deserted. The other nest, found on December 1, was just finished. The next day the body of the female flycatcher was found near by, partly eaten.

PYROCEPHALUS RUBINEUS RUBINEUS (Boddaert).

M. C. Z. 96,817. Im. ♂. Argentina: Santa Elena, Entre Rios. 15 February, 1924.
M. C. Z. 96,818. Ad. ♂. Argentina: Concepcion, Tucuman. 17 November, 1923.

These specimens agree with others in the M. C. Z.

In Tucuman this bird was found in open Acacia savannas and in bushy thickets. In Entre Rios it was observed in the bushy parts of the sandy barrancas close to the water, and one was seen in a wet meadow. Seven nests were found, all in crotches in Acacias, ranging from six to twelve feet from the ground. All were found near the Rio de Gastone, Tucuman. The nest is a beautiful little felted cup of mosses, spider webs, and plant-fibers, externally decorated with bits of bark and moss. Three of the nests found contained eggs, the others were empty. The largest number of eggs found in one nest was four. The eggs are white, slightly tinged with cream color, spotted with brownish black at the large end and pointed at the small end. In Entre Rios the present species was rare and was seen but once.

The stomachs of the specimens collected contained insect remains.

This species goes under several names, most of them referring to its brilliant coloration. In Tucuman it was called Pajaro de Fuego or Bird of Fire; in Entre Rios it was known as Churrinche.

EMPIDONOMUS AURANTIO-ATROCRISTATUS (d'Orbigny and Lafresnaye).

M. C. Z. 96,812. Ad. ♂. Argentina: Concepcion, Tucuman. 17 October, 1923.

M. C. Z. 96,813. Ad. ♀. Argentina: Concepcion, Tucuman. 9 October, 1923.

M. C. Z. 96,814. Im.? Argentina: Santa Elena, Entre Rios. 9 February, 1924.

The immature bird collected at Santa Elena is interesting in its plumage characters. The underparts are uniform as in the adult *aurantio-atrocristatus*, but the back, wings, and tail are like those of adults of *Empidonomus varius*. *Empidonomus varius* is probably the more primitive of the two existing species of the genus and the young of the more highly evolved species reveals its ancestry just as the young of *Molothrus rufoaxillaris* shows the ancestry of that species. When I was in London in 1924 I had the privilege of examining three juvenile specimens of *Empidonomus* at the British Museum. Until more is learned of these birds it may be tentatively stated that the immature plumages of both species are very similar, but that the young of *E. varius* have the underparts streaked while in *E. aurantio-atrocristatus* the underparts are uniform. The streaks in *E. varius* vary in distinctness.

This flycatcher was fairly common in open bushy districts about Concepcion and Rio de Gastone, Tucuman. It was often seen perched on the top branch of a tall bush, partly screened from view by the

foliage. It looked very sombre in life as the golden crest was not visible except on rare occasions. The only notes heard were rusty squeaks.

In an Acacia grove near the Rio de Gastone, Tucuman, I found six nests during November and December; they were rather loosely constructed saucers of small twigs and stems and averaged about six inches in diameter, and were placed in horizontal crotches in the trees anywhere from six to ten feet from the ground. One of the nests, found on November 15, contained three eggs of the tyrant and one of the cowbird, *Molothrus bonariensis bonariensis*. The other nests contained from two to four eggs each, and none of the parasite. The eggs are pale creamy in color, spotted with purplish brown chiefly towards the large end. Like the eggs of many tyrants the small end is pointed.

TYRANNUS MELANCHOLICUS MELANCHOLICUS Vieillot.

M. C. Z. 96,803. Ad. ♀. Argentina: Concepcion, Tucuman. 2 November, 1923.

M. C. Z. 96,804. Ad. ♀. Argentina: Santa Elena, Entre Rios. 7 February, 1924.

M. C. Z. 96,805. Ad. ♂. Argentina: Santa Elena, Entre Rios. 9 January, 1924.

The specimens collected agree with the series in the M. C. Z.

This bird was fairly common around Concepcion, and Rio de Gastone, Tucuman, September 23 to December 23; common, but local, at Santa Elena, Entre Rios, January 3 to February 23; several at Palermo, Buenos Aires City, March 1; and at El Tigre, Buenos Aires, March 4. In its general habits *T. melancholicus* is very similar to *T. tyrannus*, the common kingbird of North America. It was most numerous in thin forest and in open bushy places.

Hudson wrote that this species was never parasitized by the cowbird, *Molothrus bonariensis bonariensis*, but out of five nests found at Concepcion, Tucuman, three contained eggs of the parasite, and ten cases in all have come to my notice. The nest is similar to that of *T. tyrannus*, a loose structure of stems, small twigs, and rootlets, placed in a crotch in a thorn tree, anywhere from four to ten feet from the ground. The eggs, usually not more than four in a clutch, are pointed at the small end, pure white in color with brownish spots around the large end. They average about 25.5 x 19.5 mm.

MUSCIVORA TYRANNUS (Linné).

M. C. Z. 96,801. Ad. ♂. Argentina: Santa Elena, Entre Rios. 4 February, 1924.

M. C. Z. 96,802. Ad. ♂. Argentina: Concepcion, Tucuman. 28 September, 1923.

The Tijerita, as this dainty species is called by the peons, was observed at the following places:—Concepcion and Rio de Gastone, Tucuman, September 23 to December 23, common; several seen from train-window in provinces of Cordoba and Buenos Aires, September 24; in Entre Rios at Santa Elena, January 3 to February 23, common; and at San Joaquin, January 27, several; few seen at Saladero M. Cabal, Santa Fe, January 19.

When I began field-work in Tucuman on September 23 I found this species quite rare, but as the days passed migrant flocks kept coming in from the north and by the end of the month the birds were common. They are extremely attractive in life and are very active and restless. When not pursuing some insect prey they are generally seen tormenting a hawk or other large bird in the way that kingbirds often do. In flight the long tail-feathers lie straight out behind, parallel to each other, but when wheeling or turning the tail opens up like the blades of scissors. The only notes heard were little explosive *dzecp* sounds.

I found twelve occupied nests, all near Concepcion, Tucuman. Of these twelve, four contained eggs of the cowbird, *Molothrus bonariensis bonariensis*, in addition to the rightful eggs. The nest is intermediate in type between the poorly constructed nests of *Tyrannus* and the finished structure of *Suiriri*. It is cup-shaped and made of plant-fibers, cottony material, and thistle down, but these materials are mixed with bits of resinous bark which practically glue it together and make it rather hard and non-pliable. The eggs, never more than four in number, are creamy white in color, pointed at the small end, and spotted with brownish and reddish brown at the large end. The adult birds are very pugnacious around the nest.

Although these birds were seen chasing and capturing insects the stomachs of the three birds collected contained nothing but fruit-pits about the size of cherry-pits.

PHYTOTOMIDAE.

PHYTOTOMA RUTILA RUTILA Vieillot.

M. C. Z. 96,786. Ad. ♂. Argentina: Concepcion, Tucuman. 13 October, 1923.

M. C. Z. 96,787. Ad. ♂. Argentina: Concepcion, Tucuman. 2 November, 1923.

M. C. Z. 96,788. Ad. ♀. Argentina: Concepcion, Tucuman. 30 September, 1923.

M. C. Z. 96,789. Ad. ♀. Argentina: Concepcion, Tucuman. 17 October, 1923.

Of the two males collected, one (October 13) has the entire crown back to the posterior part of the occiput rufous orange while the other (November 2) has the rufous orange extending backwards only as far as the posterior end of the eye.

Plant-cutters were observed at the following localities: — Concepcion and Rio de Gastone, Tucuman, September 23 to December 23, fairly common; Santa Elena, Entre Rios, January 3 to February 23, fairly common; San Joaquin, Entre Rios, January 27, two seen. These curious birds were found in Acacia groves and in sparse, open thickets where they were usually heard more often than seen. The song of the male is very characteristic, and quite unavian in sound. Hudson described it as like the bleat of a lamb and his description can be improved only by adding that the sound is hoarser than a lamb's bleat, but otherwise similar to it. It is a deep, guttural, prolonged *aaaaaah* gradually losing in volume and finally dying out; the "a" pronounced as in the word ant.

On November 26 near the Rio de Gastone, Tucuman, I found a nest of this bird; it was a rather poorly constructed deep saucer of fine twigs, flimsily lined with plant-fibers and placed in the middle of a thorn bush and about seven feet from the ground. It measured seven inches across (outside measurements) and contained four eggs. The eggs measured 24 x 19 mm. and were a pale light olive with a bluish tinge, spotted and flecked with dark brown, chiefly at the large end.

The bills of all four birds collected were stained with the greenish sap of leaves and other vegetation eaten. The stomachs all contained finely comminuted vegetable matter.

HIRUNDINIDAE.

IRIDOPROCNE MEYENI (Cabanis).

M. C. Z. 96,784. Ad. ♂. Argentina: Concepcion, Tucuman. 28 September, 1923.

This swallow was fairly numerous around Concepcion from late September until late December. In its general habits it was quite similar to the tree swallow, *Iridoprocne bicolor*, of North America. The single specimen collected agrees with others from Mendoza and Rio Negro in the M. C. Z.

PHAEOPROGNE TAPERA TAPERA (Linné).

M. C. Z. 96,782. Im. ♀. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

M. C. Z. 96,793. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 19 February, 1924.

The plumage of the immature female is like that of the adult, but darker and less brownish on the upperparts.

This brown swallow was met with only around Santa Elena, Entre Rios, and the adjacent parts of eastern Santa Fe. Here it was not uncommon and was found breeding. It frequently nests in old nests of the ovenbird, *Furnarius rufus*, but also uses holes in trees. On January 13 I found a nest in a hole about thirty feet up in a tall tree. It contained one young bird nearly ready to leave, some fragments of egg-shells, and some feathers. The nestling was collected and found to be a female. The adult birds flew around as I robbed the nest and uttered weak *chup-chup* call-notes.

TROGLODYTIDAE.

TROGLODYTES MUSCULUS REX (Berlepsch and Leverkühn).

M. C. Z. 96,785. Ad. ♂. Argentina: Concepcion, Tucuman. 4 October, 1923.

The subspecific identification of the single specimen collected is based solely on geographic grounds, following Chapman and Griscom (Bull. A. M. N. H., 1924, 50, p. 295). However the Concepcion bird has a considerably shorter wing than any in their series of forty-six males of *rex*. They found the wings to vary in length from 51 to 57 mm., while the Concepcion specimen has a wing of only 48.5 mm., with

the other measurements as follows:—tail 43 mm.; tarsus 16 mm.; culmen, from base, 13.5 mm.

In its general habits, loud bubbling song, manner of flight, etc., this bird is very similar to the House Wren, *Troglodytes aedon*, of North America.

MIMIDAE.

MIMUS TRIURUS (Vieillot).

M. C. Z. 96,794. Ad. ♂. Argentina: Concepcion, Tucuman. 17 October, 1923.

M. C. Z. 96,795. Ad. ♂. Argentina: Santa Elena, Entre Rios. 31 January, 1924.

The January specimen was heavily moulting on the wings and body when collected. Both birds are slightly darker than specimens from Mendoza in the M. C. Z.

The Banded Mockingbird was not uncommon in thorny thickets around Concepcion, Tucuman, September 23 to December 23, and at Santa Elena, Entre Rios, January 3 to February 3. In the latter place it has been recorded as early as October (Serie and Smyth, *El hornero*, 1923, p. 52). In its general habits this species always reminded me greatly of *M. polyglottos* of North America. In flight the white patches on the wings and tail are very conspicuous and serve to identify the bird a long way off. The stomachs of the specimens collected contained insect remains.

On December 15 at Rio de Gastone, Tucuman, I witnessed what was probably the display antics of this mockingbird. The bird was seen on the ground in an open grassy field. It ran a few steps, singing as it went, then opened its wings and sprang up a foot or so in the air, bringing the body nearly to horizontal, then dropped down again, closed its wings and ran a few steps more. It kept this up in unbroken succession for a minute or more in which time it travelled about seventy feet from where it started to sing. No other bird of this species was seen in the place at the time.

MIMUS SATURNINUS MODULATOR (Gould).

M. C. Z. 96,792. Ad. ♂. Argentina: Santa Elena, Entre Rios. 10 January, 1924.

M. C. Z. 96,793. Ad. ♂. Argentina: Rio de Gastone, Tucuman. 21 November, 1923.

The two specimens collected agree with others in the M. C. Z. This calandria was common in the vicinity of Concepcion and Rio de

Gastone, September 23 to December 23; and equally common at Santa Elena, January 3 to February 23. In its general habits it is quite similar to *M. triurus* so far as my experience shows. However its song is quite inferior to that of the last-named species. It has a peculiar way of jerking its tail as it moves about, which is not noticeable in *M. triurus*. It is a species of the open country wherever there are very many trees growing here and there, and it spends much of its time on the ground.

On November 30 at Rio de Gastone I found a nest about five feet up in a bush. It contained three eggs, one that of a cowbird (*Molothrus bonariensis bonariensis*). The nest was built on the top of the ruins of an old nest of a woodhewer. I arrived in Entre Rios after the bird was through breeding. Mr. C. H. Smyth, a resident egg-collector at Santa Elena, told me that nearly every nest of this bird contains one or more eggs of the cowbird. Over a dozen cowbird eggs have been found in a single nest of this species. The eggs of the calandria vary from pale bluish, greenish, or light olive to pale olive-brown, and are abundantly marked with brownish or reddish brown. They measure (average of two specimens) 27 x 21.5 mm.

The stomachs of the birds collected contained beetles and locust remains.

TURDIDAE.

TURDUS RUFIVENTRIS RUFIVENTRIS Vieillot.

M. C. Z. 96,770. Ad. ♂. Argentina: Concepcion, Tucuman. 10 October, 1923.

The single specimen collected agrees with a series in the M. C. Z.

The Red-bellied Thrush was recorded as follows:—Buenos Aires city, September 3, one in the park near Palermo; La Plata, September 6, several; Concepcion and Rio de Gastone, Tucuman, September 23 to December 23, fairly common; in Entre Rios, Santa Elena, January 3 to February 23, abundant; San Joaquin, January 27, one.

This thrush, everywhere known as Zorzal Colorado by the Argentinians, is an inhabitant of thickets, or open woodland; and around human habitations it has adapted its habits like the North American *Planesticus migratorius*, and has become a bird of the lawns and gardens, nesting familiarly close to houses. In Mr. Stewart Shipton's garden at the Ingenio La Corona near Concepcion, several of these thrushes used to feed on crumbs almost daily.

A nest was found in this garden on November 8. It was about eight feet up in a bushy tree and was made of rootlets, fine twigs, and stems,

the whole being strengthened by mud and dried dung. The nest was empty. Near by was a young cowbird, *Molothrus bonariensis bonariensis*, just out of the nest attended by a Red-bellied Thrush.

The bird collected had one lepidopterous larva, and some vegetable matter in its stomach. Its proventriculus was infested with small parasitic worms.

TURDUS AMAUROCHALINUS Cabanis.

M. C. Z. 96,767. Ad. ♀. Argentina: Concepcion, Tucuman. 10 October, 1923.

This thrush was recorded only around Concepcion, September 23 to December 23, where it was not uncommon in thorny thickets and thin forest. It was more strictly arboreal in its habits than the last, or next species, and was never seen on the ground.

In this region I found the Zorzal Blanco, as it was called, to be quite commonly victimized by the cowbird, *Molothrus bonariensis bonariensis*. Out of eight nests found five contained eggs of the cowbird, as well as of the thrush. All the nests were placed in the center of dense bushes and ranged from four to eight feet up from the ground. The nests were well made, durable, deep cups of rootlets, small twigs, and stems matted together and strengthened by mud and caked dry dung. The eggs are light bluish green, dotted and speckled with dark brown, and average 30.5 x 21 mm. in size. The earliest nest was found on November 14, the latest on December 20. I never found more than three eggs in a nest, but owing to the presence of the cowbird eggs the number of the thrush's may have been reduced.

The specimen collected agrees with others in the M. C. Z. It had been feeding on vegetable matter.

TURDUS ANTHRACINUS Burmeister.

M. C. Z. 96,768. Ad. ♂. Argentina: Concepcion, Tucuman. 30 September, 1923.

M. C. Z. 96,769. Ad. ♀. Argentina: Concepcion, Tucuman. 9 October, 1923.

The Zorzal Negro, as this black robin was called, was observed only near Concepcion, where a few were seen during September and October. They were always found on the ground in open places, sometimes associating with the Materos, *Machetornis rixosa rixosa*, and the Tordos, *Molothrus bonariensis bonariensis*. The call-notes are loud and clear and are quite similar to those of *Planesticus migratorius* of North America. The two birds collected had been feeding on insect larvae.

SYLVIIDAE.

POLIOPTILA DUMICOLA (Vieillot).

M. C. Z. 96,771. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

M. C. Z. 96,772. Ad. ♂. Argentina: Santa Elena, Entre Rios. 9 January, 1924.

This little gnatcatcher was observed in the following localities: — Concepcion and Rio de Gastone, Tucuman, September 23 to December 23, common; Santa Elena, Entre Rios, January 3 to February 23, fairly common; Bovril Islands, Santa Fe, on and off during January and February, not uncommon. In its general habits and habitat this species greatly resembles *P. caerulea* of North America. The tail is usually held erect and jerked vigorously as the bird hops from one branch to another.

In Tucuman I found seventeen nests of this species, the earliest on October 29 and the latest on December 22. The majority were found in the last half of November and the first week in December. The nest is very similar to that of *P. caerulea*. It is a beautifully felted deep cup of plant-fibers, cottony, and woolly material, and downy feathers, and is usually placed about eight feet from the ground in rather small trees. Of the seventeen nests found, fifteen contained eggs. Of these, eight contained three eggs each, five two each, and two had one apiece. The eggs are light bluish white, marked and speckled with dark brownish, and average (ten specimens) 27 x 21.5 mm. in size. This species has been recorded by Hudson as a victim of the cowbird, *Molothrus bonariensis bonariensis*, but his record is neither definite nor explicit. None of the nests I found had been parasitized.

MOTACILLIDAE.

ANTHUS LUTESCENS LUTESCENS Pucheran.

M. C. Z. 96,777. Ad. ♂. Argentina: Concepcion, Tucuman. 19 December, 1923.

M. C. Z. 96,778. Ad. ♀. Argentina: Concepcion, Tucuman. 19 December, 1923.

The pair collected are in worn breeding plumage. They had a nest and eggs and the female was incubating at the time when collected. Measurements of the birds are as follows: — male: wing 64; tail 45;

culmen 11; tarsus 18 mm.; female: wing 63; tail 45; culmen 11; tarsus 18 mm.

They were found in a grassy meadow near Concepcion on December 19, and the species was not met with again either there or elsewhere. The nest, a partly domed grass-cup, was placed on the ground in the midst of tall grasses. It resembled the nest of a meadowlark, *Sturnella magna*, on a small scale. It contained four eggs of the pipits and one of a cowbird, *Molothrus bonariensis bonariensis*. This constitutes the first breeding record of this bird in Tucuman and also its first record as a victim of the cowbird.

Both birds collected had beetle remains in their stomachs.

CORVIDAE.

CYANOCORAX CHRYSOPS TUCUMANUS Cabanis.

M. C. Z. 96,790. Ad. ♂. Argentina: Iltico, Tucuman. 20 November, 1923.

M. C. Z. 96,791. Im ♂. Argentina: Iltico, Tucuman. 20 November, 1923.

The immature bird lacks the purple at the gape and above and below the eye.

This fine jay was noted only in the forested Andean foothills in Tucuman. At Alpachirri several were noted on October 27, while at Iltico the species was common on November 20. These birds were found in the heavy forest where they were hard to see; but their characteristic nasal, grunt-like calls quickly gave notice of their presence, and they were easily enticed into open glades by *squaking*; one was seen dusting itself on the roadside. Although single birds were noted, the species was usually found in small bunches of four or five. The specimens collected had been feeding on insects. In flight and general appearance through the trees of the forest these jays look not unlike some of the turacos (*Turacus*) of Africa.

CYCLARHIDAE.

CYCLARHIS GUJANENSIS VIRIDIS (Vieillot).

M. C. Z. 96,775. Ad. ♂. Argentina: Concepcion, Tucuman. 30 September, 1923.

M. C. Z. 96,776. Ad. ♂. Argentina: Concepcion, Tucuman. 30 September, 1923

This vireo-shrike was observed only around Concepcion, September 23 to December 23, where it was an uncommon inhabitant of open bushy and shrubby areas.

One of the males (M. C. Z. 96,776) was in breeding condition while the other (M. C. Z. 96,775) was not. The latter was probably a year-old bird. In this specimen the entire crown and nape has a brownish tinge and the flanks are tinged with light buffy brown. The adult breeding bird has no brown on the crown and very little on the flanks, but has the yellow on the breast brighter than in the other.

VIREONIDAE.

VIREO CHIVI CHIVI (Vieillot).

M. C. Z. 96,773. Ad. ♀. Argentina: Concepcion, Tucuman. 9 October, 1923.

M. C. Z. 96,774. Ad. ♀. Argentina: Concepcion, Tucuman. 9 October, 1923.

This vireo was very common in the thickets and edges of woods around Concepcion and Rio de Gastone, Tucuman, September 23 to December 23. In its habits and appearance it greatly resembles the North American *V. olivaceus*. The song is intermediate between that of *V. olivaceus* and that of *Lanivireo flavifrons*, the first phrase being clear like that of *olivaceus* and the second phrase somewhat buzzy like that of *flavifrons*.

The specimens from Concepcion agree with others from Tapia (J. L. Peters) in the M. C. Z.

COMPSOTHTYPIDAE.

GEOTHTYPIS AEQUINOCTIALIS VELATA (Vieillot).

M. C. Z. 96,779. Ad. ♂. Argentina: Concepcion, Tucuman. 19 November, 1923.

M. C. Z. 96,780. Ad. ♀. Argentina: Concepcion, Tucuman. 9 November, 1923.

M. C. Z. 96,781. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

The three birds collected agree with a series in the M. C. Z.

This warbler was observed in the following localities: — Concepcion and Rio de Gastone, Tucuman, September 23 to December 23, not uncommon; Santa Elena, Entre Rios, January 3 to February 23, uncommon, only one seen; Bovril Islands, Santa Fe, on and off during January and February, not uncommon and probably frequently overlooked.

In its secretive habits and its choice of marshy habitats this bird resembles its North American congener, *G. trichas*. All three birds collected had been feeding on insects.

COMPSOTHTYPIS PITIAYUMI PITIAYUMI (Vieillot).

This warbler was observed at Santa Elena, Entre Rios, January 3 to February 23, where it was quite common in the narrow strip of woods on the shore of the Parana. It was entirely restricted to this forested strip which in no place was more than a couple hundred yards in width. It was met with in similar moist woods in the Bovril Islands in the Parana, but was not as common there as on the mainland shore.

ICTERIDAE.

LEISTES SUPERCILIARIS PETILUS Bangs.

- M. C. Z. 96,701. Ad. ♂. Argentina: Concepcion, Tucuman. 28 November, 1923.
 M. C. Z. 96,702. Ad. ♂. Argentina: Concepcion, Tucuman. 28 November, 1923.
 M. C. Z. 96,703. Ad. ♂. Argentina: Santa Elena, Entre Rios. 8 January, 1924.
 M. C. Z. 96,704. Ad. ♂. Argentina: Santa Elena, Entre Rios. 9 January, 1924.
 M. C. Z. 96,705. Ad. ♀. Argentina: Santa Elena, Entre Rios. 9 January, 1924.

This handsome species, called Pecho Colorado in the Argentine vernacular, was observed as follows: — Concepcion, Tucuman, September 23 to December 23, locally common but not widely distributed; Santa Elena, Entre Rios, January 3 to February 23, common; Lavalle, Buenos Aires, March 10, a few seen.

The specimens collected agree with the characters and type of *ptilus* Bangs and I therefore recognize this race, although Wetmore (Bull. 133, U. S. N. M., 1926, p. 375) states that he is unable to distinguish geographic forms of *superciliaris*; he maintains that *superciliaris* is specifically distinct from *militaris*.

This species goes in small bands of from two or three to fifteen or twenty, the usual flock containing about eight or ten birds; they are not nearly as conspicuous in life as would seem likely from an examination of skins. The brilliant color of the breast is not often seen, and at a distance the birds look like cowbirds.

One of the birds collected was infested with tapeworms, but seemed to be in good condition.

PSEUDOLEISTES VIRESCENS (Vieillot).

- M. C. Z. 96,706. Im. ♂. Argentina: Santa Elena, Entre Rios. 7 January, 1924.
M. C. Z. 96,707. Im. ♂. Argentina: Santa Elena, Entre Rios. 7 January, 1924.
M. C. Z. 96,708. Im. ♂. Argentina: Santa Elena, Entre Rios. 7 January, 1924.
M. C. Z. 96,709. Ad. ♂. Argentina: Ajo, Buenos Aires. 11 March, 1924.
M. C. Z. 96,710. Ad. ♀. Argentina: Ajo, Buenos Aires. 10 March, 1924.

The Yellow-breasted Marsh-bird was observed in the following places: — Santa Elena, Entre Rios, January 3 to February 23, common; Ajo, Buenos Aires, March 9 to 11, common.

In Entre Rios this species was a very common breeding bird, but as it breeds early I arrived there too late to find any occupied nests. I found the birds in flocks composed largely of young birds in various stages of the postjuvenile moult. They were usually seen in open places where the grass was short, feeding there like so many starlings. The birds collected had seeds and ants in their stomachs. The flocks were composed of from five to a hundred birds and often contained individuals of other species such as *Leistes*, *Molothrus*, etc. Around Ajo, Buenos Aires, all the birds had completed their moult by March 10.

AMBLYRHAMPHUS HOLOSERICEUS (Scopoli).

- M. C. Z. 96,700. Im. ♂. Argentina: Deniz Island, Santa Fe. 4 January, 1924.

The Orange-headed Blackbird was observed on and off during January and February in the Bovril Islands in the Rio Parana, Santa Fe. They were all moulting at that season and were quite silent and secretive. However a few males were still in full plumage and added glowing bits of color to the otherwise sombre hue of the marshes. Small flocks used to come to a neglected maize-patch in a little clearing on Deniz Island and feed there on the young corn. The adult males have a song unmistakably akin to the *con-gercece* of *Agelaius phoeniceus* of North America, but milder and very slightly clearer and with the last syllable shorter than in the Red-winged Blackbird.

The local name for this species in Entre Rios and Santa Fe was Juan Soldado.

AGELAIUS THILIUS CHRYSOPTERUS Vieillot.

The Yellow-shouldered Blackbird was quite common in the marshes of the Bovril Islands, Santa Fe, but was extremely shy. During January and February I saw this species about a dozen times, but was

unable to collect any. In its general habits it seemed very similar to its North American relative, *A. phoeniceus*. All the birds seen were moulting and none were heard singing. The local name is Tordo de las Alas Amarillas.

AGELAIUS RUFICAPILLUS Vieillot.

M. C. Z. 96,711. Ad.? ♀. Argentina: Bovril Islands, Santa Fe. 17 February, 1924.

M. C. Z. 96,712. Ad.? ♀. Argentina: Bovril Islands, Santa Fe. 17 February, 1924.

M. C. Z. 96,713. Im. ♀. Argentina: Bovril Islands, Santa Fe. 17 February, 1924.

M. C. Z. 96,714. Im. ♂. Argentina: Concepcion, Tucuman. 17 October, 1923.

M. C. Z. 96,715. Im. ♂. Argentina: Concepcion, Tucuman. 17 October, 1923.

This bird was found around Concepcion, September 23 to December 23, in small numbers, and in the marshes of the Bovril Islands, Santa Fe, January 3 to February 23, where it was not uncommon. It was usually met with in small flocks. Hudson wrote that this species lives exclusively in the marshes and never comes near human habitations. However, in Tucuman, the only ones I saw were found feeding in a stable-yard, together with numbers of cowbirds, *Molothrus bonariensis bonariensis*. The species seems practically restricted in its diet to insect food, and its presence in stable-yards is therefore to be accounted for by the insects rather than the grain in such places. Of course it may occasionally eat grain as do most of its relatives, but all five birds collected had nothing but insect remains in their stomachs.

ICTERUS PYRRHOPTERUS PYRRHOPTERUS (Vieillot).

M. C. Z. 96,716. Ad. ♂. Argentina: Concepcion, Tucuman. 17 October, 1923.

M. C. Z. 96,717. Ad. ♀. Argentina: Concepcion, Tucuman. 30 September, 1923.

If the race *Icterus p. argoptilus* Oberholser is valid the female collected would have to be referred to that race, and *I. p. pyrrhopterus* would be the resident breeding bird of Tucuman and *I. p. argoptilus* probably a winter visitor from the south. The fact that the ovary of the female collected was very small makes it possible that the bird was a migrant or a winter visitor. The testes of the male collected were very large.

This dark oriole was met with only around Concepcion, during September, October, and November. It was very local and showed a

decided preference for shady trees along stream-banks. Most of the individuals noted were found along the Chilimayo, a little river tributary to the Rio de Gastone.

AGELAIOIDES BADIUS BADIUS (Vieillot).

- M. C. Z. 96,651. Ad. ♂. Argentina: Rio de Gastone, Tucuman. 4 December, 1923.
M. C. Z. 96,652. Ad. ♀. Argentina: San Sofia, Entre Rios. 26 January, 1924.
M. C. Z. 96,653. Im. ♂. Argentina: San Sofia, Entre Rios. 26 January, 1924.
M. C. Z. 96,654. Ad. ♂. Argentina: Concepcion, Tucuman. 2 November, 1923.
M. C. Z. 96,655. Ad. ♀. Argentina: Concepcion, Tucuman. 28 September, 1923.
M. C. Z. 96,656. Ad. ♀. Argentina: Concepcion, Tucuman. 26 September, 1923.
M. C. Z. 96,657. Ad. ♀. Argentina: Concepcion, Tucuman. 17 November, 1923.
M. C. Z. 96,658. Ad. ♂. Argentina: Santa Elena, Entre Rios. 4 February, 1924.
M. C. Z. 96,659. Ad. ♂. Argentina: Santa Elena, Entre Rios. 16 February, 1924.
M. C. Z. 96,660. Im. ♂. Argentina: Santa Elena, Entre Rios. 9 February, 1924.
M. C. Z. 96,661. Ad. ♂. Argentina: Santa Elena, Entre Rios. 16 February, 1924.
M. C. Z. 96,662. Ad. ♀. Argentina: Santa Elena, Entre Rios. 16 February, 1924.
M. C. Z. 96,663. Im. ♀. Argentina: Santa Elena, Entre Rios. 16 February, 1924.

About thirty specimens of the Bay-winged Cowbird were taken and those listed above were saved. In as much as my notes on all three cowbirds are intended for separate publication, and are far too bulky to be incorporated here, a brief summary of my findings will suffice. The Bay-winged Cowbird was observed as follows: — from train-window in the provinces of Buenos Aires, Santa Fe, Santiago del Estero, and Tucuman, September 20 to 21, many; Buenos Aires, Palermo, September 2, a few; Berisso and Enserada, September 6, fairly common; Buenos Aires City, September 15 to 20, not uncommon in the parks; Ajo, March 10, a few; Tucuman — Tucuman City, September 21, several in the parque 9 de Julio; San Pablo, September 22, several; Concepcion and Rio de Gastone, September 23 to December 23, common; Alpachirri, October 27, several; Iltico, November 20, a few; Entre Rios—

Santa Elena, January 3 to February 23, common; San Sofia, January 26, numerous; Bovril Islands, Santa Fe, and eastern Santa Fe (Saladero M. Cabal) on and off during January and February, fairly common.

Cassin (Proc. Acad. nat. sci. Phil., 1866, p. 15) proposed *Agelaioides* for this bird, but subsequent writers have united it with *Molothrus*. The Bay-wing, however, seems to deserve generic distinction from the other cowbirds and the revived genus *Agelaioides* may be characterized as follows:—non-parasitic cowbirds with short, rounded wings, no courtship display, song utterance totally unlike that of all the other cowbirds; female-type of coloration in both sexes.

In this connection it may be noted that Wetmore (Bull. 133, U. S. N. M., 1926, p. 387) suggests that generic distinction may be warranted.

The Bay-winged Cowbird is a resident bird in all parts of its range and is probably quite sedentary, each individual spending its whole life in the vicinity of its birthplace. During the winter the species goes in small flocks which break up into pairs at the approach of the breeding season. It breeds in old nests of other birds, chiefly ovenbirds (*Furnarius rufus*) or woodhewers (*Synallaxis* sev. sp., *Anumbius* sp., *Pseudoseisura* sp., and *Phacellodomus* sp.), but does occasionally build a nest itself. When this happens, the result is a fairly well-built cup of straws, grasses, and twigs, about eight inches across (outside measurement). I have seen Bay-wings fight with woodhewers for the possession of the nests of the latter so that nest-building is apparently only a last resource to the cowbirds. However, when an old nest is occupied the cowbirds do a certain amount of nest-building, changing or adding to the lining of the nest, etc. Of this work the larger part is done by the male, although both sexes work. The breeding season is late, reaching its height during January and February, and seldom beginning before December, while that of the common cowbird, *Molothrus bonariensis*, begins in October, rarely in September, and reaches its height in November and December.

The eggs, never more than five in number, are grayish white, heavily marked with brownish and brownish black, rather pointed at the small end, and average 25 x 20 mm. in size. Practically every nest of this species contains one or more eggs of the Screaming Cowbird, *Molothrus rufo-axillaris*. Out of seventy nests of the Bay-wing, sixty-five contained eggs of both species. The incubation period of the Bay-wing is twelve and a half to thirteen days.

This species is peculiar among the cowbirds in that the male has absolutely no courtship display. The song is a mellow, monotonous,

formless chant given in a weary sing-song manner and is frequently interrupted by a guttural *chuck* note. This song has no definite form as has that of the typical cowbirds (*Molothrus*), but is considered pleasing by the natives who have given the bird the name of Musico. The song is given by both sexes, but chiefly by males.

Local names for this species are numerous, the following being those most commonly used: — Tordo Colorado, Muraju (Guarani Indian), Musico, and Mulato.

MOLOTHRUS RUFO-AXILLARIS Cassin.

- M. C. Z. 96,664. Ad. ♂. Argentina: Santa Elena, Entre Rios. 16 January, 1924.
 M. C. Z. 96,665. Im. ♀. Argentina: Ajo, Buenos Aires. 10 March, 1924.
 M. C. Z. 96,666. Ad. ♂. Argentina: Ajo, Buenos Aires. 11 March, 1924.
 M. C. Z. 96,667. Ad. ♂. Argentina: Ajo, Buenos Aires. 10 March, 1924.
 M. C. Z. 96,668. Ad. ♂. Argentina: Ajo, Buenos Aires. 11 March, 1924.
 M. C. Z. 96,669. Ad. ♂. Argentina: Ajo, Buenos Aires. 10 March, 1924.
 M. C. Z. 96,670. Ad. ♂. Argentina: Concepcion, Tucuman. 4 November, 1923.
 M. C. Z. 96,671. Ad. ♂. Argentina: Concepcion, Tucuman. 3 November, 1923.
 M. C. Z. 96,672. Ad. ♂. Argentina: Concepcion, Tucuman. 13 October, 1923.
 M. C. Z. 96,673. Ad. ♀. Argentina: Concepcion, Tucuman. 1 November, 1923.
 M. C. Z. 96,674. Ad. ♀. Argentina: Concepcion, Tucuman. 8 October, 1923.
 M. C. Z. 96,675. Ad. ♂. Argentina: Concepcion, Tucuman. 8 October, 1923.
 M. C. Z. 96,676. Ad. ♀. Argentina: Concepcion, Tucuman. 26 September, 1923.
 M. C. Z. 96,677. Ad. ♂. Argentina: Concepcion, Tucuman. 5 December, 1923.
 M. C. Z. 96,678. Im. ♂. Argentina: Rosas, Buenos Aires. 12 March, 1924.

The name *brevirostris* d'Orbigny and Lafresnaye currently used for the present species is preoccupied by *brevirostris* Swainson (Animals in meng., 1837, p. 305), which is a synonym of *bonariensis* Cabanis.

In addition to the specimens listed above about twenty others were taken at various times as checks on field-observations, but were not saved as specimens. The Screaming Cowbird was observed as follows: — Tucuman, Concepcion, and Rio de Gastone, September 23 to December 23, common; Alpachirri, October 27, a few; Iltico, November 20, one seen; Entre Rios, Santa Elena, January 3 to February 23, not uncommon; San Sofia, January 26, several; Buenos Aires

— Ajo, March 8 to 11, fairly common; Buenos Aires City, March 15, several seen at Palermo.

This species is non-migratory and quite local in its distribution. In the field it resembles *Molothrus b. bonariensis*, but may readily be distinguished by its notes. The peons seldom differentiate between the two species and apply Tordo to both. A few of the peons who know the two birds call the present species Tordo Negro and the Common Cowbird simply Tordo.

The Screaming Cowbird is always found in pairs throughout most of the year, but in winter small flocks are sometimes seen. These flocks, however, are flocks of pairs rather than of individuals as the birds generally fly off in pairs when disturbed. When flying they utter a harsh series of guttural *chuck* notes, both sexes being equally vociferous. The song of the male and the accompanying display in courtship may be described as follows: — the male fluffs out all his body and head-feathers, bends the tail forward and under, arches the wings to a nearly horizontal position, and then quivers all over as though trying to catch his breath. After about a second of this quivering, without bowing forward at all, he finally emits a very rusty, but quite explosive, squeak-*dzeee*. The quivering and the sudden delivery of the note after considerable convulsive hesitations gives the impression that the note stuck in the bird's throat and was finally expectorated. The *dzeee* note is quickly followed by a two-syllabled *pe-tzeee* sound, the first syllable very short and the second long and drawn-out, but shorter than the corresponding note in *bonariensis* and *ater*. These two notes are not nearly as clear and glassy in quality as the corresponding notes of either *M. ater* or *M. bonariensis* and are also lower in pitch; the Screaming Cowbird does not give the preliminary bubbling guttural notes that the other two do. In Tucuman the courtship season began in early October, but the species did not begin to breed until late in December.

This species is parasitic on the Bay-winged Cowbird, and in regions where the former is at all common very few nests of the latter are not victimized. (*M. rufo-axillaris* has never been known to occur in places where *A. badius* was not present). Out of some seventy nests of the Bay-wing on which I have data sixty-five contained eggs of the Screaming Cowbird. Three is the largest number of *rufo-axillaris* eggs ever found in one nest of *badius*. The eggs are very similar to those of the Bay-wing. In size they average around 18 x 23 mm. and are usually less slender in appearance than those of *badius*. In any nest it is always easy to distinguish the eggs of the two, but if a large series were mixed together it would be practically impossible to tell defi-

nately in all cases which eggs belonged to each species. However, the eggs of the Screaming Cowbird are usually less brittle, harder to pierce, and less reddish in color than those of the Bay-wing. The majority of eggs of the former that I have seen were marked with purplish brown while most of those of the latter were spotted with reddish or dark grayish brown. The ground-color of the eggs is always white. The number laid by one individual is about five and the eggs are laid at daily intervals. The incubation period is twelve and a half to thirteen days.

Although the adults of this species are very different in plumage from adult Bay-wings the young of the two are identical and are Bay-wings in appearance. The young of the two grow up together in harmony and the Bay-wings do not suffer because of the parasites. This similarity in plumage is undoubtedly due to community of phylogenetic descent rather than to adaptive mimicry.

MOLOTHRUS BONARIENSIS BONARIENSIS (Gmelin).

- M. C. Z. 96,679. Ad. ♂. Argentina: Concepcion, Tucuman. 26 September, 1923.
 M. C. Z. 96,680. Ad. ♂. Argentina: Concepcion, Tucuman. 2 October, 1923.
 M. C. Z. 96,681. Ad. ♀. Argentina: Concepcion, Tucuman. 3 October, 1923.
 M. C. Z. 96,682. Ad. ♂. Argentina: Concepcion, Tucuman. 26 September, 1923.
 M. C. Z. 96,683. Ad. ♂. Argentina: Concepcion, Tucuman. 2 October, 1923.
 M. C. Z. 96,684. Ad. ♀. Argentina: Concepcion, Tucuman. 15 October, 1923.
 M. C. Z. 96,685. Ad. ♂. Argentina: Concepcion, Tucuman. 26 September, 1923.
 M. C. Z. 96,686. Ad. ♀. Argentina: Concepcion, Tucuman. 3 October, 1923.
 M. C. Z. 96,687. Ad. ♂. Argentina: Concepcion, Tucuman. 26 September, 1923.
 M. C. Z. 96,688. Ad. ♂. Argentina: Concepcion, Tucuman. 2 October, 1923.
 M. C. Z. 96,689. Ad. ♂. Argentina: Concepcion, Tucuman. 26 September, 1923.
 M. C. Z. 96,690. Ad. ♀. Argentina: Concepcion, Tucuman. 3 October, 1923.
 M. C. Z. 96,691. Ad. ♀. Argentina: Concepcion, Tucuman. 19 November, 1923.
 M. C. Z. 96,692. Ad. ♂. Argentina: Concepcion, Tucuman. 26 September, 1923.
 M. C. Z. 96,693. Ad. ♂. Argentina: Concepcion, Tucuman. 3 November, 1923.
 M. C. Z. 96,694. Ad. ♂. Argentina: Concepcion, Tucuman. 19 November, 1923.

- M. C. Z. 96,695. Ad. ♀. Argentina: Bovril Islands, Santa Fe. 10 February, 1924.
M. C. Z. 96,696. Im. ♂. Argentina: Rio de Gastone, Tucuman. 15 December, 1923.
M. C. Z. 96,697. Im. ♂. Argentina: Santa Elena, Entre Rios. 30 January, 1924.
M. C. Z. 96,698. Ad. ♂. Argentina: Santa Elena, Entre Rios. 9 January, 1924.
M. C. Z. 96,699. Im. ♂. Argentina: Santa Elena, Entre Rios. 5 February, 1924.

About a hundred birds of this species were collected at various times, and those listed were saved as specimens. This bird, the common cowbird of Argentina, is an extremely abundant species almost everywhere north of Patagonia and to record the places and dates of its observation would be to list every spot visited during the six and a half months I spent in the country.

This cowbird is migratory in the southern part of its range as far north as Buenos Aires, the individuals breeding in the south passing the winter in Tucuman, Santiago del Estero, etc. Some are to be found the year round at Buenos Aires, but the number increases greatly during September. On September 20, from a train-window I saw great flocks of these birds flying southward. Some of the flocks must have contained at least five thousand birds. In Tucuman I was able to make an intensive study of the migration and found that the males leave for the south before the females and the old birds before the year-old birds. Even in Tucuman where the species is resident¹ throughout the year the breeding individuals are not the same as those that winter there. The migrant birds arrive before the resident ones in spring. Unlike *M. ater* of North America it is usually possible to distinguish year-old birds from older ones in this species because in fully 75% of the cases some of the juvenile feathers are retained in the first nuptial plumage.

The courting season begins early in October in Tucuman and from this time until the middle of December males are commonly seen indulging in their displays. The display is quite similar to that of *M. ater* of North America, but the bowing is not carried to as extreme a degree, and the display is more commonly given on the ground than in trees, while in the case of the latter species the reverse is true. The song is also like that of *M. ater*, but less clear. It begins indefinitely well down in the throat and the first sounds are of a curious combination of purr-

ing and bubbling. Three low, bubbling guttural notes are belched forth by the bird with considerable bodily quivering, and sound as though they were forced up through water. They are all alike and may be written *purr purr purr* but the *rrrs* are softened so that the bubbling sound is produced. Closely following these three notes come three high, rather glassy, thin notes, the first two short and somewhat run together, and the last one long and drawn-out — *pe-tsss-tseeeeee*, very much like those of *M. ater*, but slightly buzzier.

Like *M. ater* the present species is more or less monogamous, but wherever it is very common and the struggle for breeding territory keen, the sexual relations are easily distorted and a state of something akin to promiscuity results.

The eggs are subject to greater variation in size, color, and markings than are those of any other cowbird. In size they vary from 20 x 26 to 18 x 22 mm., averaging around 19 x 23 mm. In shape they may be almost spherical, rounded ovate, oval, ovate, or elliptical ovate.¹ The oval and ovate are the commonest types. In color they vary from pure, spotless white to very heavily marked with reddish brown. The ground-color varies from white and cream to light bluish, greenish, or very pale brownish. The pure white type of egg is geographical in occurrence, being found almost wholly in eastern Argentina, Uruguay, and southern Brazil and unknown throughout the rest of the range of the species. Wetmore (Bull. 133, U. S. N. M., 1926, p. 385) suggests that this white egg may have been developed because the greater number, "... of the tracheophone species which form so conspicuous an element among the smaller birds that breed in the area frequented by this cowbird lay white unmarked eggs." With this I disagree entirely. A study of the nests in which white cowbirds' eggs have been found shows no preponderance of tracheophones over other birds when compared with the results of a similar study of nests in which marked eggs have been taken. Most of the pure white eggs have not been found in nests of tracheophone species, but in nests of species of *Brachyspiza*, *Minus*, and *Pseudoleistes*. It seems impossible to attach any particular significance to these white eggs, but it may be that with the loss of the parental instincts and the accompanying ideas of protection which manifest themselves structurally in color, etc., as well as directly inhabit, there may be a corresponding lack of stimulus to the pigment glands of the oviduct. If this be so, then it would seem as though similarity between the eggs of the cowbird and those of its victims had no selective value and that the species was gradually losing the un-

¹ Egg-contour terms according to Ridgway's Nomenclature, p. 16.

necessary pigmentation of its eggs. However, until more is known of the physiology of egg-pigmentation this matter may best be left unexplained. Any present hypothesis would be based more on lack of knowledge than on the possession of facts.

The eggs are laid at daily intervals and probably the number is not nearly as large as Hudson thought. He believed the number laid by one bird to be from 60–100 a season. I feel that it is from 6–10, a very considerable difference. My arguments and evidence are too bulky for inclusion here. Eggs of this cowbird were found in eighty nests of the following nineteen species.

Furnarius rufus rufus, *F. cristatus*, *Muscivora tyrannus*, *Suiriri suiriri*, *Myiophobus fasciatus flammiceps*, *Empidonomus aurantio-atrocristatus*, *Myiodynastes solitarius*, *Machetornis rixosa rixosa*, *Tyrannus melancholicus melancholicus*, *Turdus rufiventris*, *T. amaurochalinus*, *Mimus saturninus modulator*, *Anthus lutescens*, *Saltator aurantirostris*, *S. caeruleascens caeruleascens*, *Brachypiza capensis capensis*, *Sporophila caeruleascens*, *Sicalis pelzelni*, *Paroaria cristata*. Over eighty species of birds are known to be victimized by this cowbird. The incubation period is eleven days.

THRAUPIDAE.

THRAUPIS BONARIENSIS (Gmelin).

M. C. Z. 96,765. Ad. ♂. Argentina: Concepcion, Tucuman. 5 December, 1923.

This tanager was observed in the following localities: — Buenos Aires City, September 3, several in the park at Palermo; La Plata City and vicinity, September 6, several; Concepción and Rio de Gastone, Tucuman, September 23 to December 23, not uncommon; Entre Rios — Santa Elena, January and February, few. The Naranjero, as this bird is called in the vernacular, was found only in the more wooded places in the vicinity of water, although in city parks in Buenos Aires and La Plata it was also found in very open glades. They seem to go singly or in pairs as no flocks were met with. In their general habits they resemble the Scarlet Tanager (*Piranga olivacea*) of North America, feeding in the tree-tops, always active and restless. The bird collected had many small seeds in its stomach.

THRAUPIS SAYACA OBSCURA Naumburg.

M. C. Z. 96,766. Ad. ♀. Argentina: Concepcion, Tucuman. 10 October, 1923.

This light bluish bird was met with in Tucuman, and not elsewhere. At Concepcion, and the Rio de Gastone, September 23 to December 23,

it was uncommon in the open patches of scrubby forest. At La Corona it came into the orange groves at the manager's house and was said by the natives to peck at the fruit and eat the pulp. For this reason it was called Naranjero or Orange-bird. This name however, was indiscriminately applied to all tanagers and warblers.

The bird collected agrees with the characters of *obscura* as given by Naumburg (Auk, 1924, 41, p. 111).

FRINGILLIDAE.

SALTATOR CAERULESCENS CAERULESCENS Vieillot.

M. C. Z. 96,761. Ad. ♀. Argentina: Concepcion, Tucuman. 30 September, 1923.

M. C. Z. 96,762. Ad. ♂. Argentina: Concepcion, Tucuman. 9 October, 1923.

M. C. Z. 96,763. Ad. ♀. Argentina: Concepcion, Tucuman. 7 October, 1923.

M. C. Z. 96,764. Ad. ♂. Argentina: Bovril Islands, Entre Rios. 13 January, 1924.

The series collected shows considerable variation in the color of the underparts, some specimens being quite gray while others are brownish. I have not seen any comparative Argentine material and cannot decide if it has any particular significance. Around Concepcion and Rio de Gastone, Tucuman, September 23 to December 23, this bird was very common. It was usually found in bushes along roadsides, but also in real dense thickets. In western Entre Rios (Santa Elena) January 3 to February 23, it was seen occasionally. It never seems to go in flocks and most of the birds seen were single individuals. It was quite uncommon to see both members of a pair together except near the nest.

In Tucuman I found nine occupied nests. The earliest date I have for eggs is November 11, the latest December 20. The nests were in bushes and from four to seven feet up from the ground. The nests were well-made cups of straws, dead grasses, fine rootlets, etc., about three inches deep and eight inches across. The eggs are beautiful bright green or greenish blue, scrawled with zigzag black lines at the large end. They measure 26 x 19.5 mm. Of the nine nests that I found none contained more than three eggs of the Saltator. Two nests contained, in addition to the three eggs, one egg each of the cowbird *Molothrus b. bonariensis*. The eggs of the parasite are smaller than those of the Saltator, but yet the latter rears the young Molothrus. Whether its own young survive or not I cannot say. I have seen adults feeding

fully fledged three quarters grown young cowbirds on several occasions, but in none of these instances were there any of their own young present. In Tucuman this bird was called Papitero, in Entre Rios it went by the name of Juan Chiviro.

SALTATOR AURANTHIROSTRIS AURANTHIROSTRIS Vieillot.

M. C. Z. 96,757. Ad. ♂. Argentina: Santa Elena, Entre Rios. 16 January, 1924.

M. C. Z. 96,758. Ad. ♂. Argentina: Santa Elena, Entre Rios. 16 January, 1924.

M. C. Z. 96,759. Ad. ♂. Argentina: Santa Elena, Entre Rios. 18 February, 1924.

M. C. Z. 96,760. Ad. ♀. Argentina: Concepcion, Tucuman. 10 October, 1923.

The specimens collected agree with a series in the M. C. Z. Immature birds are very buffy below like adult females.

Around Concepcion, September 23 to December 23, I found this species somewhat uncommon, and was unsuccessful in finding nests. In western Entre Rios (Santa Elena), January 3 to February 23, it was considerably commoner, but all the nests I found were empty as it was rather late in the season. On January 30 at Santa Elena I saw a fully grown young cowbird, *Molothrus b. bonariensis*, being fed by an Orange-billed Saltator.

In its general habits this Saltator resembles the preceding species very closely, being found in the same type of country.

The vernacular names in Entre Rios were Juan Chiviro and Juan Chiviro de Pico Amarillo. In Tucuman it was called Papitero de Pico Colorado.

GUBERNATRIX CRISTATA (Vieillot).

M. C. Z. 96,733. Ad. ♂. Argentina. Santa Elena, Entre Rios. 9 February, 1924.

M. C. Z. 96,734. Im. ♂. Argentina: San Joaquin, Entre Rios. 27 January, 1924.

The Yellow Cardinal was observed only in western Entre Rios where I found it to be a very local and rather scarce species. During seven weeks of field-work in that region I saw it but twice: — a single male at Santa Elena on February 9, and two birds at San Joaquin on January 27. The species seems restricted to the more open spaces in thorny tangles and usually perches in a conspicuous, elevated place. The crest, which is generally held erect, gives the bird a rather distinguished appearance.

CYANOCOMPSA CYANEA ARGENTINA (Sharpe).

M. C. Z. 96,718. Ad. ♂. Argentina: Concepcion, Tucuman. 7 October, 1923.

M. C. Z. 96,719. Ad. ♂. Argentina: Concepcion, Tucuman. 9 October, 1923.

M. C. Z. 96,720. Ad. ♀. Argentina: Concepcion, Tucuman. 12 November, 1923.

This species was met with only at Concepcion, September 23 to December 23, where it was not uncommon in bushy fields and pastures. They were rather shy and difficult to approach and very silent.

The three specimens agree with others in the M. C. Z.

PAROARIA CRISTATA (Boddaert).

M. C. Z. 96,726. Ad. ♂. Argentina: Concepcion, Tucuman. 18 October, 1923.

M. C. Z. 96,727. Ad. ♀. Argentina: Concepcion, Tucuman. 9 October, 1923.

M. C. Z. 96,728. Im. ♂. Argentina: Santa Elena, Entre Rios. 15 January, 1924.

The Crested Cardinal was observed at the following places:—Buenos Aires City, September 3, one; La Plata and vicinity, September 6, several; Concepcion and Rio de Gastone, Tucuman, September 23 to December 23, fairly common; Santa Elena, January 3 to February 23, common. This Cardinal is often kept as a cage-bird in Argentina on account of its powers as a songster. The song is not nearly as fine as that of the *Cardinalis cardinalis* of North America, but seems quite exceptional among all the tracheophone species with which it lives. The present species is found in dry Acacia savannas as well as in thickets or thin forest, being completely isolated ecologically from *Coccoopsis capitata* which so greatly resembles it in life. Several nests were found near Concepcion and the Rio de Gastone, during November and December. They were all placed in sheltered crotches in trees and were from five to ten feet up from the ground. They were made of grasses, rootlets, and straws, rather compactly matted together, and are more solidly built than are those of the next species. The eggs, usually three in number, are white, speckled and spotted with olive-brown and olive greenish, frequently with some fine blackish pencilings at the large end. They average 24 x 18 mm. in size. One nest, found on December 3, contained one egg of the cowbird, *Molothrus b. bonariensis*, in addition to one of the Cardinal. One of the birds collected had been feeding on insects; the others had seeds in their stomachs.

COCCOPSIS CAPITATA (d'Orbigny and Lafresnaye).

M. C. Z. 96,725. Ad. ♀. Argentina: Deniz Island, Santa Fe. 4 January, 1924.

The Yellow-billed Cardinal was observed only in the Bovril Islands in the Rio Parana, where during January and February I found it not uncommon. It is entirely restricted to moist woodlands and is not found on either shore of the river because of the absence of proper environment. This has given it a most amazing local range:—for over a hundred miles this species occurs in a narrow strip, only a few miles wide, while on either side of it *Paroaria cristata* flourishes, but at no point do the two exist coincidentally. A nest was found on January 4 on Deniz Island, Santa Fe. It was about fifteen feet up in a good-sized tree in a wet forest. In it were three eggs very similar to those of *Paroaria cristata*.

SPOROPHILA CAERULESCENS (Vieillot).

The little Screaming Finch was seen a few times during November and December at Concepcion, Tucuman. On December 10 I found a nest, a very dainty, strong cup of fine grasses, in a large bush and about five feet from the ground. It was partly suspended in vireo-fashion from the tip of a branch. It contained one egg of the finch and three of the cowbird, *Molothrus b. bonariensis*. In Entre Rios (Santa Elena and vicinity), January 3 to February 23, I found the Corbatita, as it was called there, fairly numerous, but quite shy. In Tucuman it was anything but shy, being one of the birds that commonly fed close to houses.

SPOROPHILA LINEOLA (Linné).

M. C. Z. 96,749. Ad. ♂. Argentina: Concepcion, Tucuman. 5 December, 1923.

M. C. Z. 96,750. Ad. ♂. Argentina: Concepcion, Tucuman. 5 December, 1923.

M. C. Z. 96,751. Ad. ♂. Argentina: Concepcion, Tucuman. 5 December, 1923.

M. C. Z. 96,752. Ad. ♀. Argentina: Concepcion, Tucuman. 12 December, 1923.

The small series collected agree with others in the M. C. Z. This little finch was seen only in the garden of Mr. S. Shipton at La Corona, a mile outside of Concepcion. It was first seen on December 5 when about half a dozen were noted and three collected and was last seen on

December 12, when a few were noted and one collected. In as much as I had often walked in the garden during November and had not seen this bird I feel quite confident that those seen were recent arrivals. After the 12th I looked for them several times, but never saw the species again.

CATAMENIA ANALIS (d'Orbigny and Lafresnaye).

M. C. Z. 96,744. Ad. ♂. Argentina: Concepcion, Tucuman. 10 October, 1923.

M. C. Z. 96,745. Ad. ♀. Argentina: Concepcion, Tucuman. 4 October, 1923.

The male collected agrees with the type specimen. The female is darker than a female from Cochabamba, Bolivia, in the M. C. Z.

The species was observed near Concepcion, during October and November. There it was somewhat uncommon and was found in but one locality, a bushy strip along the railway embankment. It kept to the low bushes and weeds most of the time, but occasionally one mounted a tall bush or weed-stem and sang a weak, soft, twittering song. The birds collected had small seeds in their stomachs.

VOLATINIA JACARINA JACARINA (Linné).

M. C. Z. 96,729. Ad. ♂. Argentina: Santa Elena, Entre Rios. 8 February, 1924.

M. C. Z. 96,730. Ad. ♂. Argentina: Santa Elena, Entre Rios. 16 January, 1924.

The two males collected agree with a series in the M. C. Z. This little finch with the general manners of a *Hypochera* (Ploceidae) was observed only at Santa Elena. It apparently was a new-comer there as Serie and Smyth (*El hornero*, 1923, p. 37-55) do not list it in their account of the birds of this region. On January 8 I saw one sitting in a bush when it suddenly sprang up vertically into the air for about a yard, and as it came down again to its perch it uttered a little beady *dzeee cep*, the second syllable slightly higher than the first. For several minutes it kept repeating this performance at intervals of about ten seconds. Just as I was ready to believe that it never sings without leaping into the air, it sang without leaving its perch. On January 16 I saw this same performance from several different males, so that it seems that this species regularly jumps up and down while singing, much like some of the manakins.

SICALIS PELZELNI Slater.

M. C. Z. 96,721. Ad. ♂. Argentina: Concepcion, Tucuman. 29 September, 1923.

M. C. Z. 96,722. Ad. ♂. Argentina: Concepcion, Tucuman. 17 October, 1923.

M. C. Z. 96,723. Ad. ♀. Argentina: Concepcion, Tucuman. 17 October, 1923.

The three birds collected agree with a series in the M. C. Z. This species was observed only at Concepcion and Rio de Gastone, Tucuman, September 23 to December 23, where it was fairly common in open Acacia savannas. It was found breeding in old nests of *Synallaxis* sp. On November 23 at Rio de Gastone I found a nest occupied by *Sicalis pelzelni* containing an egg of the cowbird, *Molothrus b. bonariensis*, as well as two of the finch. These little yellow finches are the ecological counterpart in the neotropics of the members of the genus *Serinus* in the African tropics, and like them go in small flocks and feed among the grass and weeds. In some ways, particularly in their undulating flight, they bear a general resemblance to goldfinches (*Astragalinus tristis*).

ARREMON ORBIGNII Slater.

M. C. Z. 96,724. Ad. ♂. Argentina: Concepcion, Tucuman. 6 October, 1923.

This bird was seen but once and then collected on sight so that I have no field-notes. It was seen in a bushy hedge at the edge of a cart-road and was on the ground. The iris in life was dark brown.

CORYPHOSPINGUS CUCULLATUS ARAGUIRA (Vieillot).

M. C. Z. 96,746. Ad. ♂. Argentina: Concepcion, Tucuman. 7 October, 1923.

M. C. Z. 96,747. Ad. ♀. Argentina: Concepcion, Tucuman. 10 October, 1923.

M. C. Z. 96,748. Ad. ♀. Argentina: Concepcion, Tucuman. 7 October, 1923.

I have not seen sufficient comparative material to be sure of the validity of *araguira*, but follow Wetmore in calling the birds from Argentina this race.

At Concepcion, September 23 to December 23, this species was found rather uncommonly in bushy patches in open country. It was generally seen in pairs and was quite nervous and shy. It was always on the go, never still for a second, flitting from branch to branch and down to the ground and back again. Both seeds and insects were found in the stomachs of the three specimens collected.

BRACHYSPIZA CAPENSIS ARGENTINA Todd.

M. C. Z. 96,739. Im. ♂. Argentina: Santa Elena, Entre Rios. 18 February, 1924.

M. C. Z. 96,740. Ad. ♂. Argentina: Concepcion, Tucuman. 4 October, 1923.

M. C. Z. 96,741. Ad. ♂. Argentina: Concepcion, Tucuman. 4 October, 1923.

According to Wetmore (Bull. 133, U. S. N. M., 1926, p. 415) the resident form of Tucuman (at least at Tapia) is *hypoleuca* Todd. However I cannot distinguish my two Concepcion birds from *argentina* as represented in the collections of the M. C. Z. The measurements of the two males are as follows:

Sex	Locality	Wing	Tail	Culmen	Tarsus
♂	Concepcion	71	64	11.5	18
♂	Concepcion	69	59	12	18

The immature plumage is as follows: — underparts white, heavily spotted with grayish brown, the center of the throat unspotted, lower abdomen also unspotted but tinged with light buff; upperparts grayish brown, heavily streaked with blackish brown, the crown grayish in the middle streaked with blackish brown, the sides also streaked with blackish brown; superciliary stripe white with small brown streaks; primaries edged with rufous, the outermost five pairs having the rufous edges extremely light and narrow; the secondaries externally edged with rufous and tipped with white; tail dark grayish brown edged with pale light grayish brown.

This sparrow, the Argentina counterpart of the Song Sparrow, *Melospiza melodia*, was very common everywhere I went in the course of the entire trip. The song is one of the most persistent sounds in the country, and like that of the Song Sparrow is hard to describe accurately. It has a cadence suggestive of both *Melospiza* and *Zonotrichia* and yet easily different from either. The song consists of clear, mellow whistled notes much run together at the end and varies considerably with different individuals.

In the course of my work I found thirty-three nests of this sparrow. Of these, twenty-nine contained eggs, and of these twenty-nine no less than twenty-four had one or more eggs of the cowbird, *Molothrus b. bonariensis*, in addition to those of the sparrow. The present species is by all odds the commonest victim of the cowbird. Probably more young cowbirds are raised by Chingolos, as these sparrows are called, than by the four next commonest victims combined. The largest number of the parasitic eggs that I ever found in one nest was eight

along with one of the sparrow. The nests were mostly on the ground at the bases of weeds or small bushes, but several of them were in bushes and vines, the highest being about seven feet up. The nests are poorly built when compared to those of the Song Sparrow, and are smaller. They are made of fine grasses, thin stems, etc., and when off the ground generally have an outer layer of slightly coarser and heavier stems and rootlets. The eggs, of which five seem to be the maximum number to a clutch, are very variable in color, some being pale greenish, others white, and still others light bluish. All are spotted with brownish or blackish brown. They average about 18 x 16 mm. in size. The earliest date on which I found nests with eggs was October 16, the latest, January 27.

POOSPIZA MELANOLEUCA (d'Orbigny and Lafresnaye).

- M. C. Z. 96,736. Ad. ♀. Argentina: Concepcion, Tucuman. 6 October, 1923.
M. C. Z. 96,737. Ad. ♂. Argentina: Concepcion, Tucuman. 2 October, 1923.
M. C. Z. 96,738. Ad. ♀. Argentina: Santa Elena, Entre Rios. 13 January, 1924.

The specimens collected agree with a series in the M. C. Z. This species was met with in small numbers in Tucuman and Entre Rios. They were very shy and lived in dense bushy thickets, making observation difficult. When flitting about the white in the tail shows clearly.

POOSPIZA WHITH Selater.

- M. C. Z. 96,735. Ad. ♂. Argentina: Concepcion, Tucuman. 7 October, 1923.

This pleasing little finch was very uncommon in my experience. The single bird seen was collected among a clump of low bushes where it was flitting around restlessly.

SALTATRICULA MULTICOLOR (Burmeister).

- M. C. Z. 96,731. Ad. ♂. Argentina: Santa Elena, Entre Rios. 15 January, 1924.
M. C. Z. 96,732. Ad. ♂. Argentina: Santa Elena, Entre Rios. 9 January, 1924.

These birds are in worn breeding plumage and lack the rufous edgings to the greater wing-coverts. Females have the cheeks very gray while the males have black cheeks. This species, one of the most colorful sparrows in Argentina, was fairly common in the dry thorn-bush country in western Entre Rios (near Santa Elena) during my

stay there in January and February. They were usually found in small groups of three or four feeding on the ground or in the lower thorny bushes. The usual call-note was a *chip* or *tsip* note given with considerable emphasis.

EMBERNAGRA OLIVASCENS OLIVASCENS d'Orbigny.

M. C. Z. 96,753. Ad. ♂. Argentina: Concepcion, Tucuman. 17 October, 1923.

M. C. Z. 96,754. Ad. ♀. Argentina: Concepcion, Tucuman. 12 October, 1923.

M. C. Z. 96,755. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

M. C. Z. 96,756. Ad. ♂. Argentina: Bovril Islands, Santa Fe. 13 January, 1924.

The four birds collected are smaller, grayer, and darker than two Lafresnaye specimens from Bolivia in the M. C. Z. These terrestrial finches were found in the following localities: Concepcion, September 23 to December 23, fairly common; Bovril Islands, Santa Fe, January and February, uncommon. In Tucuman they seemed to inhabit nothing but Alfalfa fields, the vegetation affording good cover, and a plentiful food-supply. In Santa Fe they were found in a little dry meadow in one of the higher parts of one of the Bovril Islands, but they were seen but once in this place.

The flight is peculiar. The birds seem to jump up suddenly and fly off with rapid wing-beats and dangling feet. Often they cock their tails as they fly.

PASSER DOMESTICUS (Linné).

The Gorrion, as this bird is called, was observed in Buenos Aires City, at Concepcion, Tucuman, and at Parana, Entre Rios. At Concepcion it apparently arrived at least five years before my visit (*i.e.* in 1918). The species has taken to breeding in old nests of the ovenbird, *Furnarius rufus*. They were common in Buenos Aires city and uncommon at Parana.

SPINUS MAGELLANICUS TUCUMANUS Todd.

M. C. Z. 96,742. Ad. ♂. Argentina: Concepcion, Tucuman. 17 October, 1923.

M. C. Z. 96,743. Ad. ♀. Argentina: Concepcion, Tucuman. 7 October, 1923.

Both specimens collected are in worn breeding plumage and lack the white edges to the secondaries present in fresh plumaged birds.

The species was not uncommon in the Acacia savannas around Concepcion, September 23 to December 23. They are found in small flocks much like the finch, *Sicalis pelzelni*. Both birds collected had been feeding on small grass-seeds.

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BY HENRY B. BIGELOW AND WILLIAM C. SCHROEDER.

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No. 5.— *Notes on Northwest Atlantic Sharks and Skates.*

By HENRY B. BIGELOW AND WILLIAM C. SCHROEDER.

ISURIDAE. Mackerel Sharks.

DURING the past few years several mackerel sharks have been collected in the Gulf of Maine, on cruises of the U. S. B. F. Steamer HALCYON. And as there has been considerable confusion as to the relationship between American and North European sharks of this group, as well as in the synonymy of the former, the following description and discussion is offered.

Two very different types of isurids (apart from *Carcharodon*) have been reported from the east coast of the United States and all the isurids so reported fall in one or other of these two categories.

- A. A stout-bodied shark with first dorsal originating over or slightly behind the axil of the pectoral; second dorsal originating over the origin of the anal; lower caudal lobe only about 70% as long as upper: and with all the teeth essentially similar, except for the presence or absence of lateral denticles (cf. p. 240).
- B. More slender, with sharper nose; first dorsal originating well behind the pectoral; second dorsal originating definitely in advance of the anal; lower caudal lobe 75% as long as upper; first two teeth from the median suture, in both jaws, notably longer and more flexuous than the others.

Five specimens of type A, recently caught on Platts Bank, off Portland, Maine, and on Nantucket Shoals, Massachusetts, agree in all respects with the Common Porbeagle (*Isurus nasus* (Bonnaterre)) of the eastern Atlantic, as the following description shows:—

1. ISURUS NASUS (Bonnaterre). Common Porbeagle.

Four specimens, Platts Bank, 60, 52, 50, and 49 inches long, taken respectively August 15, 1924; September 3, 1925, September 3, 1925 and June 21, 1925; and one specimen, Nantucket Shoals, 51 inches long, taken June 17, 1927.

In all of these the body is fusiform, massive; the snout conical, pointed. The distance from tip of snout to anterior edge of eye is equal

to distance from tip of snout to mouth, which in turn, is about equal to length of shortest gill-slit. The origin of first dorsal stands over, or slightly behind the arm-pit (axil) of the pectoral. The height of first dorsal about equals one half the distance from the tip of snout to first gill-slit; the anterior margin of this fin is convex, its upper angle rounded, its posterior margin concave. The second dorsal is very small, its origin over, or very slightly in advance of origin of anal (the second dorsal of *I. tigris* is distinctly in advance of anal). The anal is very small, similar to second dorsal in outline. The lower lobe of caudal is about 70% as long as the upper lobe, each measured from its respective caudal pit; the margin lunate. The length of the ventrals is less than length of the snout; the length of the pectoral equal to, or slightly greater than, the distance from lower caudal pit to tip of lower caudal lobe. Upper and lower caudal pits are prominent; and there is a strong median lateral keel on each side of the caudal peduncle.

The teeth are all alike in shape (in *I. tigris* the front teeth are more slender and flexuous than the others); twenty-eight rows in the upper jaw and twenty-six rows in the lower in these specimens; rather widely spaced, with narrow-pointed cusps, smooth edged, each tooth, in the larger specimens, with a small sharp denticle on either side of the wide base. In the midline of each jaw there is a toothless space about as wide as one tooth. In the lower jaw the first two teeth on each side of this median gap are the largest, the remaining teeth decreasing in size toward the angle of the mouth. In the upper jaw the first two teeth on each side are the largest, the third tooth much smaller (also in *I. tigris*), with the remaining teeth larger but decreasing in size laterally.

In the smallest specimen, forty-nine inches in length, the basal denticles are so small that they might easily be overlooked. On the fifty-two inch fish these denticles are somewhat larger, and plainly visible on all the teeth; on the sixty-inch fish and in a forty-two inch specimen from Massachusetts Bay, in the M. C. Z., they are prominent.

The presence and size of the basal denticles thus appears to be an age-character, suggesting that small fish, less than four feet in length, might have teeth without denticles. Günther (1870, p. 389), Day (1884, p. 297), and Smitt (1895, p. 1140) do, in fact, point out that young fish lack them.

Color gray above, gray or greenish blue along the sides; white below. Tail uniform gray-blue; pectorals dusky underneath on outer half or third; anal white or slightly dusky.

The stomach of the forty-nine inch specimen contained fish-bones and thirty-six squid-beaks.

The measurements of three of these five fish are as follows:—

	Measurements in inches		
Total length	60	52	49
Snout to caudal pit	48	43 $\frac{1}{2}$	..
origin of first dorsal	20 $\frac{1}{2}$	19 $\frac{3}{4}$	18
origin of second dorsal	42 $\frac{1}{2}$	38 $\frac{1}{2}$	..
anterior margin of eye	4 $\frac{1}{2}$	..	3 $\frac{3}{4}$
anterior margin of mouth	4 $\frac{1}{2}$	..	..
first gill-slit	13 $\frac{1}{2}$	11 $\frac{1}{2}$	11
fifth gill-slit	17	14 $\frac{1}{2}$	14
Posterior first dorsal to anterior second dorsal	16 $\frac{1}{4}$	13	13 $\frac{1}{4}$
Height of first dorsal	6 $\frac{1}{4}$	6	..
Origin of first dorsal to tip	8 $\frac{1}{4}$	7 $\frac{1}{2}$	..
Height of second dorsal	1	1	..
Height of anal	1	1	..
Upper caudal pit to tip of upper caudal lobe	15	12	..
Lower caudal pit to tip of lower caudal lobe	10	9	..
Length of pectoral	11 $\frac{1}{4}$	9 $\frac{1}{2}$	..
Distance between pectoral tips	25	22 $\frac{1}{2}$	..
Width of gill-slits	4 $\frac{1}{2}$ to 5	4 to 4 $\frac{1}{2}$	..
Position of second dorsal with respect to anal	exactly opposite	dorsal origin slightly in advance of anal	exactly opposite
Teeth	28	28	28
	26	26	26

These specimens corroborate the identifications of our predecessors,¹ who considered the American mackerel sharks of this general type as *Isurus nasus*, and prove the latter the common species of this group in the Gulf of Maine.

There is no danger of confusing *I. nasus* with its sharp-nosed relative, *I. tigris* (cf. p. 243). But certain of the published descriptions² suggest the existence in northeastern American waters of another stout-bodied mackerel shark, agreeing with *I. nasus* in the forward location

¹ *Lamna cornubica* Bean, 1889, Goode & Bean, 1879, p. 29; Goode, 1884, p. 670; Jordan & Gilbert, 1883, p. 30; Jordan & Evermann, 1896, p. 49; Prince & MacKay, 1901, p. 55; Bean, 1901, p. 380; Bean, 1903, p. 39; Fowler, 1906, p. 56; Tracy, 1910, p. 60; Kendall, 1908, p. 7; *Isurus nasus* Garman, 1913, p. 34; Fowler, 1920, p. 143; Huntsman, 1922, p. 8 (56); Bigelow & Welsh, 1925, p. 551; *Lamna nasus* Hubbs, 1923, p. 101.

² *Lamna punctata* Storer, 1839a, p. 185; 1839b, p. 534; 1846, p. 504; 1867, p. 249; *Oxyrhina punctata* Gray, 1851, p. 60 (non Mitchill, 1815); *Oxyrhina dekayi* Gill, 1861; *Isuropsis glaucus* Gill, 1865; *Isurus oryrlhynchus* Jordan & Gilbert, 1883, p. 29; *Isurus spallanzani* Jordan & Gilbert, 1883, p. 874; *Isurus punctatus* Garman, 1888, 1913, p. 36; Bigelow & Welsh, 1925, p. 36, & 551.

of the first dorsal, in the situation of the second dorsal relative to the anal, and in the stout body, but differing from it, and resembling *I. tigris* in lacking lateral denticles on the teeth even when adult.

An American shark of this type was described by Storer (1839, 1846, 1867). He, it is true, referred it to the *Squalus punctatus* of Mitchill (1815), a carcharinid (probably *Scoliodon*). Actually, however, Storer's fish was an isurid, as Gill (1861) pointed out, and his illustration shows the stout form, forward location of the first dorsal, and second dorsal above the anal, characteristic of *I. nasus*. It would, in fact, unhesitatingly be referred to that species, were not denticles lacking in the single tooth figured (Storer, 1839a, pl. 3, fig. 2). On the strength, presumably, of this, Gill (1861, 1864), successively referred Storer's *punctata* to *Oxyrhina* L. Agassiz, and to *Isuropsis* Gill, genera opposed to *Lamna* Cuvier (containing the Common European Porbeagle, correctly known as *Isurus nasus* (Bonnaterre)).

Dumeril (1865, p. 409) also separated Storer's *punctata* generically from the latter on the same grounds, supposed absence of lateral denticles on the teeth. And since that time it has by some been classed as identical with the allied, but quite distinct, *Isurus tigris*¹ *deKayi* Gill, *partim*; by some it has been regarded as a good species distinct both from *I. tigris* and from *I. nasus*²; and by others it has been considered identical with the Common Porbeagle of Europe, which, as noted above, has in fact been recorded repeatedly from the western Atlantic, under its own name, either as *Isurus nasus* or as *Lamna cornubica* (p. 241).³

The first of these alternatives need not delay us; quite apart from the structure of the teeth, Storer's *punctata* is at once separable from *Isurus tigris*, and from the European representative of the later (*I. oxyrinchus*), by the position of the first dorsal fin relative to the pectoral, and of the second dorsal relative to the anal, as well as by the blunter head, and stout body. The second alternative, that in addition to *I. tigris* and *I. nasus*, the western Atlantic harbors a third mackerel shark resembling the latter in all respects except that its teeth lack the lateral denticles, is supported by Garman's description of specimens from American waters. At first sight this might seem sufficient proof that *I. punctatus* is in fact separable from *I. nasus*, though so closely allied to the latter that only by examination of the teeth can the one be separated from the other. For the following reasons, however, we believe that this supposed difference, denticles present in *nasus* but

¹ Gunther, 1870; Uhler & Lugger (1878); Jordan & Gilbert, 1883; Bean, 1903; Kendall, 1908, p. 7.

² Garman, 1913; Nichols & Murphy, 1916; Bigelow & Welsh, 1925, p. 36.

³ Kendall, 1908; Bigelow & Welsh, 1925, p. 551.

absent in *punctatus*, is merely an age-character combined with individual variation:—

1. Small European specimens of *nasus*, up to about three and one half feet long, are known to lack denticles on some or all of the teeth. Young specimens from the Gulf of Maine are the same in this respect, as appears from the HALCYON series, just described (p. 240).

2. The dissection of *I. punctatus*, shown by Garman (1913, pl. 62, fig. 2), was from a small specimen; and one of the beautiful drawings shows small denticles on two of the teeth, when sufficiently magnified. Other Massachusetts specimens, respectively about four and eight feet long, in the M. C. Z., have the denticles well developed.

3. Not a single jaw of a large mackerel shark of the *punctatus-nasus* type, has been actually described as lacking denticles, since Storer's time. Garman (1913, p. 36), it is true, includes in the synonymy of *I. punctatus* a specimen of *Lamna cornubica* recorded by Jordan and Gilbert (1883, p. 29). But photographs of the jaws of this specimen, contributed by Dr. H. L. Bruner of Butler College, show prominent denticles; classing it as a typical *nasus*.

Except, then, for Storer's figure of a single tooth, there is no published evidence that sharks of the *nasus-punctatus* type ever grow to large size in American waters without finally developing the lateral denticles on some if not on all of the teeth. And even should an odd specimen fail to develop these structures, this occasional retention, to maturity, of a juvenile character, would not warrant a separate specific name.

The present state of our knowledge is therefore best represented by definitely relegating the *I. punctatus* of Storer and of Garman to the synonym of *I. nasus* (Bonnaterre).

The presence or absence of the lateral denticles on the teeth being to some extent an intergrading character, the difference between the one local mackerel shark which definitely lacks them (*I. tigris*) and the other which usually develops them (*I. nasus*) is regarded as specific, not generic; consequently both are included under the generic designation earliest applied to either of them — *Isurus* (Rafinesque 1810).

Mutual relationship of the two species of *Isurus* so far known from the northeastern Atlantic may then be tabulated as follows:—

- A. Snout only moderately pointed: body massive: origin of first dorsal over axil or posterior part of pectoral: origin of second dorsal over origin of anal or very slightly in advance of latter: lower caudal lobe only about 70% as long as upper. Teeth all essentially similar in shape, with basal denticles in adult, though these denticles may be lacking on some or all of the teeth in young specimens. *Isurus nasus* (Bonnaterre).

- B. Snout much sharper; trunk more slender; origin of first dorsal posterior to pectoral; origin of second dorsal well anterior to anal; lower caudal lobe relatively longer than in *I. nasus*, or about 75% as long as upper; no lateral denticles on teeth; first two teeth from the median line of mouth longer than the others, and more flexuous *I. tigris* (Atwood).

2. GALEUS GLAUCUS (Linné.) Great Blue Shark.

The capture of eight Great Blue Sharks in various parts of the Gulf of Maine, during 1925 and 1926, leads to the belief that this species, heretofore regarded as a straggler there, is one of the more common of local sharks, for besides the fish actually caught, many others were seen.

Along our coast there are no records of this blue shark south of New York. Bean (1903, p. 25) and Nichols and Murphy (1916, p. 9) state that it is "occasionally" found. At Woods Hole it is reported as one of the rarer sharks. Bigelow and Welsh (1925, p. 29), summarizing its known occurrence in the western North Atlantic, mention only one record from the Gulf of Maine. But they point out that sundry specimens have been captured, or seen off the outer coast of Nova Scotia; several, for example at Halifax; and at Canso, where fishermen describe these "blue dogs" as common on the fishing banks (Cornish, 1907); suggesting that it is actually much commoner along the eastern seaboard of North America than the paucity of definite records might suggest.

This is corroborated by the following list of Great Blue Sharks, caught or seen, from the HALCYON and ALBATROSS II, during cod tagging operations:—

August 24, 1925, Great Rip, Nantucket Shoals, one caught (nine and one half feet) and one other observed; August 26, 1925, Stellwagon Bank, Massachusetts Bay, one caught (eleven feet) and one other observed; September 2, 1925, northern end of Jeffreys Ledge, two observed; September 3, 1925, Platts Bank, four caught (six and one half to seven feet) and about twelve others observed, at times four or five swimming close to the ship. On this occasion blue sharks were in sight at nearly all times throughout the day, swimming at the surface.

Two (about ten and one half feet long) were caught on Georges Bank, and another seen, on August 15, 1926.

Measurements in inches of the specimens taken were as follows:—

	Aug. 24, 1925 Great Rip Nantucket Shoals	Aug. 26, 1925 Middle Bank Massachusetts Bay	Sept. 3, 1925 Platts Bank Gulf of Maine	Sept. 3, 1925 Platts Bank Gulf of Maine	Sept. 3, 1925 Platts Bank Gulf of Maine	Sept. 3, 1925 Platts Bank Gulf of Maine	Aug. 15, 1926 Georges Bank	Aug. 15, 1926 Georges Bank
1. Total length	114	132	80	80	77	86½	126	124
2. Snout to anterior eye	..	10	7¼	7	6½	7	9½	9½
3. to anterior mouth	..	..	..	7½	7	7¾	10¼	10
4. to first gill-slit	22½	25½	15¾	15¾	15½	16½	23½	23½
5. to fifth gill-slit	29½	33	19½	19½	18¾	20¾	30	29½
6. to origin of first dorsal	45½	48	31½	31½	30	34½	45½	46
7. to origin of second dorsal	..	87	54	54	52½	57½	82½	81½
8. to caudal pit	90	101½	62	62½	60½	66½	96	96
9. Diameter of eye	..	1¾	..	..	1⅛	1¼	1½	..
10. Distance between angles of mouth	..	10	5¾	..	5½	6	9	9
11. Height of first dorsal	..	10	5½	6	5¾	5¾	12½	9½
12. of second dorsal	..	4	2	2	1¾	2¼	3½	3¼
13. of anal	..	5¼	2¼	2¼	1¾	3	..	4
14. Posterior first dorsal to anterior second dorsal	24	29½	17½	17½	17	18¼	..	..
15. Caudal pit to tip of lobe, upper	30	34	21½	20	19¾	23	31	30½
16. lower	14¾	17½	9½	9¾	9¾	11¼	16½	17
17. Length of pectoral	27	29	15¼	17¼	16	18	27	27
18. Distance between pectoral tips	62½	64	35½	38	33½	36½	59	..
20. Teeth	31 31	28 23	29 29	29 29	29 30	29 29	..	..
21. Sex	Male	Male	..	..	..	..	Male	Male

Although the Great Blue Shark enters the Gulf of Maine in some numbers in certain summers, at least (perhaps not every summer), apparently it seldom comes close in to this sector of the coast line: witness the paucity of records from the pounds, traps, and weirs. This, indeed, is in line with its pelagic habit.

The maximum size to which the Great Blue Shark grows is of interest. Certainly very few if any of the specimens which visit the coastal zone, in either side of the North Atlantic, are more than eleven or twelve feet long. The largest specimen captured (listed above) was eleven feet. So, too, was Day's largest, from Great Britain. Couch (1862, p. 36) states "the largest I have heard of, but not seen, was

upwards of fourteen feet long." And recent authors, generally, have credited it with a usual maximum length of 10-12 feet. Among blue sharks, as among other fishes, an occasional specimen may perhaps grow much larger than the generality, for it has been reported, says Day (1884), to attain twenty-five feet, while Lilljeborg (1891, p. 610) credits it with 7.5 meters (about twenty-four and one half feet). But such great lengths, if not mere rumor, would be most exceptional.

3. RAJA GRANULATA Goode and Bean (Gill MS.).

In 1879 Goode and Bean, from a manuscript description by Gill, gave this name to a skate from La Have Bank, the exact relationship of which, to other northwestern Atlantic skates, has since remained something of an enigma. The original very brief notice of this "remarkable species" (Goode and Bean, 1879, p. 28) merely described it as of the same type as the barn-door skate (now known as *R. stabuliforis*), with ventral as well as dorsal side "covered with minute sharp granular ossifications"; "with 30-31 teeth on each side; the back granulated and slate-colored; the ventrals distinguished by reticulate markings, and the claspers slender and scarcely expanded." Subsequently Goode and Bean (1896) and Jordan and Evermann (1896) suggest that *granulata* is identical with the "Barndoor" (*R. stabuliforis*; then known as *R. laevis*). Jensen (1914, p. 31), however, from examination of a specimen in the U. S. N. M., from the continental edge in the offing of Halifax (Lat. 42° 37' N; Long. 62° 55' W), has shown that this is not the case, but that *R. granulata* has large middorsal thorns on the disk (seven in the specimen) as well as on the tail; besides one large preorbital, two postorbital, and two scapular spines. He also mentions the "fine, small spines" which cover the upper surface, giving "the skin to the naked eye a grained (granulated) appearance." But he states that the lower surface is perfectly smooth, not prickly as Goode and Bean described it. The specimen examined by us, from the same locality, however, is covered almost everywhere with minute rounded tubercles, below, as well as above.

Unfortunately it seems that the original specimen of *R. granulata* is no longer extant. But these brief notices of the species can be supplemented by the following description of a female specimen from the offing of Halifax, 200 fathoms, in the U. S. N. M. (Cat. 23,483).

Length of disk 1.36 in width; anterolateral margin slightly convex opposite eyes; posterolateral margin nearly straight; angles of disk

slightly more acute than a right angle, rounded at extreme corners. Snout acute, its distance to anterior margin of eye 5.1 in the width of the disk. Interorbital (bone) transversely concave, 2.5 in snout to eye; spiracles close to eyes, the distance between their inner margins 1.3 in snout to eye. Mouth forming an obtuse angle, very wide, its width 4.8 in width of disk. Teeth rather long and pointed, with broad base, in about $\frac{28}{8}$ rows on each side. Distance between first gill-slits 3.8 and between fifth gill-slits, 5.6 in width of disk. Outer margin of ventrals gently rounded, the length of fin about equal to distance from eye to snout. The distance from anterior margin of anus to origin of first dorsal 2.4, and to second dorsal 2.1, in width of disk. Height of first dorsal slightly less than distance from second dorsal to end of tail; height of second dorsal equal to distance between dorsals, which equals 1.8 interorbital (bone).

Upper surface with a row of eight large spines along median line of back, the first anterior to the shoulder-girdle and the last, smaller than the others, a little posterior to the pelvic girdle. Tail with a median row of five large spines, the distance from anterior end of base of first spine to posterior fifth spine, 2.2 in distance from fifth spine to end of tail. A spine in front of and in line with inner margin of eye; a patch of three spines behind eye and opposite inner angle of spiracle, the middle spine much smaller than the other two. Two spines on shoulder, the anterior one the closest to the median line. Numerous small prickles with stellate bases, on snout, on interorbital, along anterolateral margin of disk, along posterolateral disk somewhat in from the margin. A few small prickles along the back and many along the sides of tail. Naked or nearly naked areas occur between and posterior to the spiracles, between the back and basal cartilage of the pectorals, along the median line of back between the large spines, and on the ventrals. Ventral surface of body covered rather sparsely almost everywhere with minute rounded tubercles.

Color in alcohol, light brown above, margins of pectorals and ventrals somewhat darker; light below, margins of pectorals dark brown with large dark areas toward center of body and on ventrals (the visceral cavity has been cut away).

Measurements.

	mm.
Total length	850
Length of disk	480
Width of disk	655

Snout to eye.....	132
Disk across middle of eyes.....	270
Interorbital (bone).....	51
Distance between spiracles.....	95
" " first gill-slits.....	174
" " fifth gill-slits.....	117
Snout to median mouth.....	106
Width of mouth.....	135
Anterior anus to end of tail.....	363
" " " origin first dorsal.....	272
" " " " second dorsal.....	311
Distance between dorsals.....	29
Posterior margin second dorsal to end of tail.....	45
Height of first dorsal.....	42
" " second dorsal.....	28
Anterior base of first middorsal tail spine to posterior base of fifth.....	95
Fifth middorsal tail-spine to end of tail.....	210

BIBLIOGRAPHY.

BEAN, T. H.

1889. Notes on the cruise of the GRAMPUS on the southern mackerel grounds during the spring fishery of 1887. Bull. U. S. F. C. for 1887, **7**, p. 241-258.

1901. Catalogue of the fishes of Long Island. 6th ann. rept. forest, fish and game comm. N. Y., for 1900, p. 373-478.

1903. Catalogue of the fishes of New York. Bull. 60, Zool., **9**, N. Y. state mus., 784 pp.

BIGELOW, H. B. AND WELSH, W. W.

1925. Fishes of the Gulf of Maine. Bull. U. S. B. F., **40**, pt. 1, 567 pp.

BONNATERRE, J. P.

1788. Tableau encyclopédique et méthodique des trois règnes de la nature * * * Ichthyologie. Paris, 56, 215 pp., 100 pls.

CORNISH, G. A.

1907. Notes on the fishes of Canso. Contrib. Canad. biol., 1902-1905, p. 81-90.

COUCH, JONATHAN.

1862. A history of the fishes of the British Islands. London, **1**.

DAY, FRANCIS.

1880-1884. The fishes of Great Britain and Ireland. London, Edinburgh, 3 vols., text and plates.

DUMÉRIL, A. H. A.

1865. Histoire naturelle des poissons, ou ichthyologie générale. Paris, **1**, 720 pp.

FOWLER, H. W.

1906a. The fishes of New Jersey. Ann rept. N. J. state mus. for 1905, p. 35-477, 103 pls.

1906b. Some unusual New Jersey fishes. Science, new ser., **24**, p. 596-597.

1920. A list of the fishes of New Jersey. Proc. Biol. soc. Wash., **33**, p. 139-170.

GARMAN, SAMUEL.

1888. On the lateral canal system of the Selachia and Holocephala. Bull. M. C. Z., **17**, p. 57-119, 53 pls.

1913. The Plagiostomia. (Sharks, skates and rays). Mem. M. C. Z., **36**, 13,515 pp., 77 pls.

GILL, THEODORE.

1861. Catalogue of the fishes of the eastern coast of North America from Greenland to Georgia. Proc. Acad. nat. sci. Phil. Suppl., p. 1-63.

1864. Synopsis of the eastern American sharks. Proc. Acad. nat. sci. Phil., p. 258-265.

1865. Synopsis of the fishes of the Gulf of St. Lawrence and Bay of Fundy. Can. nat. and geol., new ser., **2**, p. 244-266.

GOODE, G. B. AND BEAN, T. H.

1879. A list of the fishes of Essex county, * * * Bull. Essex inst., **11**, p. 1-38.

1896. Oceanic ichthyology. Mem. M. C. Z., **22**, 35, 26, 553, 23, 26 pp., 123 pls. Spec. bull. 2 U. S. N. M. Smith. contrib., **30**.

GOODE, G. B. AND OTHERS.

1884. The food fishes of the United States. The fisheries and fisheries industries of the U. S. Washington, sect. 1, pt. 3, p. 163-682, pl. 35-252.

GRAY, J. E.

1851. List of the specimens of fish in the collection of the British museum. Part 1. Chondropterygii. London, 160 pp., 2 pls.

GÜNTHER, A. C. L. G.

1870. Catalogue of the fishes in the British museum. London, **8**, 549 pp.

HUBBS, C. L.

1923. Notes on a small collection of fishes from Monhegan island, Maine. Copeia, no. 123, p. 101-103.

HUNTSMAN, A. G.

1922. The fishes of the Bay of Fundy. Contrib. Canad. biol., 1921, no. 3, p. 49-72; also p. 1-24.

JENSEN, A. S.

1914. The selachians of Greenland. Mind. Japetus Steenstrup, 1914, no. 30, 40 pp., pl.

JORDAN, D. S. AND EVERMANN, B. W.

1896-1900. The fishes of North and Middle America. Bull. 47, U. S. N. M., pt. 1-4, 3313 pp., 392 pls.

JORDAN, D. S. AND GILBERT, C. H.

1883. Synopsis of the fishes of North America. Bull. 16, U. S. N. M., 1018 pp.

KENDALL, W. C.

1908. Fauna of New England. 8. List of the Pisces. Occ. papers Bost. soc. nat. hist., **7**, no. 8, 152 pp.

LILLJEBORG, WILHELM.

1891. Sveriges och Norges. Fiskar. Upsala, [3, pt. 2], p. 337-672.

MITCHILL, S. L.

1815. Fisheries of New York * * * Trans. Lit. and philos. soc. N. Y., **1**, 355-492, pl. 1-6.

NICHOLS, J. T. AND MURPHY, R. C.

1916. Long Island Fauna. 4. The sharks (order Selachii). Brooklyn mus. sci. bull., **3**, no. 1, p. 1-34.

PRINCE, E. E. AND MAC KAY, A. H.

1901. The paired fins of the Mackerel shark. Contrib. Canad. biol., 1901, p. 55-58, pl. 5-7.

RAFINESQUE, C. S.

1810. Caratteri di alcuni nuovi generi e nuove specie di animali e piante della Sicilia * * *. Palermo, 105 pp., 20 pls.

SMITT, F. A.

1895. A history of Scandinavian fishes by B. Fries and others. Ed. 2. Stockholm, **2**, p. 567-1240, pls. 28-53.

STORER, D. H.

- 1839a. Fishes of Massachusetts. Rept. fishes, reptiles and birds of Massachusetts, Boston, p. 5-202.

- 1839b. A report on the fishes of Massachusetts. Bost. journ. nat. hist., **2**, p. 289-558.

1846. A synopsis of the fishes of North America. Mem. Amer. acad., new ser., **2**, p. 253-550.

- 1853-1867. A history of the fishes of Massachusetts. Mem. Amer. acad., new ser., **5-9**. Separate: Cambridge and Boston, 1867.

TRACY, H. C.

1910. Annotated list of fishes known to inhabit the waters of Rhode Island. 40th rept. Comm. fish. R. I., p. 35-176.

UHLER, P. R. AND LUGGER, OTTO.

1878. Additions to list of fishes of Maryland. Rept. Comm. fisheries Maryland for 1877, p. 57-94.

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SHALER MEMORIAL SERIES.

**THE BRACHIOPODS OF THE OTTOSEE AND HOLSTON
FORMATIONS OF TENNESSEE AND VIRGINIA.**

BY BRADFORD WILLARD.

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ATHENS FORMATIONS OF TENNESSEE AND VIRGINIA.**

BY PERCY E. RAYMOND.

WITH THREE PLATES.

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No. 6a. — *The Brachiopods of the Ottosee and Holston Formations of Tennessee and Virginia.*

By BRADFORD WILLARD.

INTRODUCTION.

In the following paper will be found descriptions of certain species of brachiopods which occur in the Ottosee and Holston formations in Tennessee and Virginia. The material is part of that collected by members of the Shaler Memorial Expeditions sent from Harvard University during the field seasons of 1917, 1918 and 1921. Although several brief lists of the fossils of these formations have been published, no attempt to describe the brachiopods has previously been made.

Class BRACHIOPODA Duméril.

Order ATREMATA Beecher.

Superfamily LINGULACEA Waagen.

Family LINGULIDAE Gray.

Genus PALAEOGLOSSA Cockerell.

PALAEOGLOSSA BELLI (Billings).

Lingula belli Billings, Canadian nat. and geologist. ser. 1, 1859, 4, p. 431-432, fig. 7, 8; Geol. Surv. Canada, 1863, p. 124, fig. 47a-b.

Glossina belli Raymond, Ann. Carnegie mus., 1911, 8, p. 216, pl. 33, fig. 1.

Obolus belli Walcott, Mem. U.S.G.S., 1912, 51, pt. 1, p. 386, pl. 38, fig. 3, 3a-b.

Although somewhat smaller than the specimens figured by either Raymond or Walcott, the material at hand shows in all other particulars close similarity to the type. The specimens studied include one well-preserved pedicle valve and several fragments of both valves. They have a uniform curvature, with the pedicle valve sharply pointed posteriorly and the brachial blunt in that direction. The anterior edge shows an evenly curved outline. Surface markings are subequal growth lines. The presence of deeply impressed muscle-scars is evident in the exfoliated individuals, the shell being thicker than the typical *Lingulas*. The dimensions are: length 21 mm., width 17 mm., length-width index 123. The size and curved anterior margin together with the difference

in the posterior extremities in the two valves serve to distinguish the species.

Horizon and Locality:—Holston, Ross and Republic Quarry, 3 miles southeast of Knoxville, Tenn.; and Chazy, Island of Montreal, Canada, and Valcour Island, N. Y.

PALAEOGLOSSA GIBBOSA, sp. nov.

Plate 1, fig. 3.

This is a large brachiopod, thick-shelled, with the pedicle valve the larger of the two, due to the posterior end being pointed and extended over the pedicle. The exterior is covered with strong, concentric markings when not exfoliated. The dimensions are: length 26 mm., width 25 mm., height 11 mm., length-width index 104. The greatest width is two-thirds of the distance forward from the posterior limits of the shell.

Horizon and Locality:—Murat limestone, Lexington, Va. Holotype no. S587, M. C. Z.

Genus LINGULA Bruguière.

LINGULA LYELLI Billings.

Plate 1, fig. 2.

Lingula lyelli Billings, Can. nat. and geol., 1859, 4, p. 348, fig. 1a-d, p. 431. Geol. Canada, 1863, p. 124, fig. 49. Chapman, Canadian jour., n. s., 1863, 8, p. 195, fig. 165c. Expos. min. geol. Canada, 1864, p. 167, fig. 165c. Raymond, Ann. Carnegie mus., 1911, 7, p. 218, pl. 33, fig. 5, 6.

A *Lingula* somewhat doubtfully referred to this species is represented in the collection by several more or less well-preserved specimens. It agrees with *L. lyelli* in its elongate, narrow, almost parallel-sided form; but no individuals yet found reach the size of the normal specimens from the Chazy of Ontario. The index of Canadian shells (pedicle valve) ranges from 180 to 215. That of the most perfect specimens from the Ottosee is 180 for the pedicle and 175 for the brachial valve. Mature examples of the species have nearly straight sides and are rather blunt in front. The valves are not evenly convex, but show flattened slopes. The surface markings are fine, concentric growth lines. Dimensions: length of brachial valve, 14 mm., width 8 mm., length-width index 175. The greatest width is just forward of the

middle. The species differs from other *Lingulas* of the horizon in its high index, rather small size and the flattened areas of the valves.

Horizon and Locality:—Holston, McNutt Quarry, Sharon Springs, Va. Figured specimen no. 8586 in the M. C. Z.

LINGULA NARRAWAYI Wilson.

Lingula narrawayi Wilson, Canadian geol. surv., Victoria mem. mus. bull., **33**, 1921, p. 49, pl. 3, fig. 4.

This species has small valves with subovate outline and faint concentric markings, the interiors of the valves not being preserved among the materials studied. The shell is very thin and delicate, which, with its small size, are the chief distinctive features of this species. Owing to the ill state of preservation of the material, the finer details could not be determined. Dimensions: length 5.5 mm., width 2.5 mm., length-width index 220.

Horizon and Locality:—Holston, three miles east of Blacksburg, Va., and Lowville, Ottawa, Canada.

Order NEOTREMATA Beecher.

Superfamily SIPHONOTRETACEA Walcott and Schuchert.

Family SIPHONOTRETIDAE Kutorga.

Genus SCHIZAMBON Walcott.

SCHIZAMBON CUNEATUS, sp. nov.

Plate 1, fig. 4.

The species is represented by a single well-preserved individual and several fragments. The shell is oval, rather depressed and evenly curved with a deep pedicle opening. The surface is marked by heavy, compound, concentric growth lamellae and ornamented by numerous spines, averaging about 2 mm. in length. The dimensions of a pedicle valve are: length 15.5 mm., width 13.5 mm., length-width index 114. Widest point seems to be about one-third of the length back from the anterior margin. The form differs from *S. dodgei* in being more pointed posteriorly and from *S. duplicimuratus* in its greater size.

Horizon and Locality:—Holston, McNutt Quarry, Sharon Springs, Va., and also from the Ottosee at the base of the formation, north of Luttrell, Tenn. Holotype, no. 8588, M. C. Z.

Subfamily ACROTRETACEA
Family ACROTRETIDAE Schuchert.
Superfamily ACROTRETINAE Matthew.
Genus CONOTRETA Walcott.

CONOTRETA DECLIVIS, sp. nov.

Pedicle valve small, high, semioval in outline, with wide, flat or slightly concave false area, along the median line of which the course of the pedicle tube is visible. The beak is far back, above the hinge, so that the area is nearly vertical. Surface ornamented by fine, concentric lines.

The apex of the cast of the interior of the shell is deeply indented by a narrow fissure which extends about one-quarter of the way down to the front of the shell. On either side of it are faintly impressed, radiating, longitudinal scars like those of *Conotreta rusti*.

Remarks.

This species differs from *Conotreta rusti* Walcott (Proc. U. S. nat. mus., 1890, 12, p. 365, fig. 1-4) in the semioval instead of nearly square outline, and in having the beak further back, forming a nearly vertical false area. In the latter feature it resembles *C. conoidea* Reed (Trans. Roy. soc. Edinburgh, 1917, 51, p. 817, pl. 4, fig. 1-5) from the Stinchar limestone of Scotland.

Measurements: — The holotype is 2.5 mm. long, 3 mm. wide and 2.5 mm. high.

Horizon and Locality: — A single specimen was found in the Holston limestone at the McNutt Quarry at Sharon Springs, Va., and is no. 8593 in the M. C. Z.

Family ACROSACCIDAE nov.

Shells similar in structure to *Acrothele*, but with the dorsal protegulum intramarginal.

Genus ACROSACCUS nov.

Pedicle valve conical, without, or rarely with, a false cardinal area. Dorsal protegulum near the posterior margin. Genotype, *Acrosaccus shuleri* sp. nov.

ACROSACCUS SHULERI, sp. nov.

Plate 3, figs. 1, 2.

Pedicle shell circular in outline, nearly evenly conical, the apex a little behind the middle, the apical angle being about 90° , as viewed from the front. The posterior slope is slightly convex, without false area, but showing, in the present partially exfoliated condition, the course of the pedicle tube. Apex sharp, with an exceedingly minute scar of the pedicle opening, the tube having apparently been closed by a plug at maturity. Surface marked by closely spaced, sharp, elevated, concentric lines.

Brachial valve almost circular, nearly flat, the beak slightly elevated and situated near the posterior margin. Ornamentation like that of the pedicle valve.

Remarks.

Taken by itself, the pedicle valve of this species would be referred to *Acrothele*, but the intramarginal position of the beak of a brachial valve having the same ornamentation indicates that not only is the shell not an *Acrothele*, but does not belong to the *Acrotretidae*. The presence of a pedicle tube proves the relationship to the *Acrotretacea* rather than the *Discinacea*.

Measurements: — The pedicle valve is 9.5 mm. long and the width is the same; the height is 5 mm. The brachial valve is that of a smaller individual, being 5 mm. in diameter.

Horizon and Locality: — A rare species in the Holston limestone at the McNutt Quarry at Sharon Springs, Va. Cotypes no. 8591, M. C. Z.

ACROSACCUS PANNEUS, sp. nov.

Plate 3, fig. 3.

Ventral valve depressed conical, with the apex back of the center. All slopes gently convex, the apical angle being about 110° . The specimen is exposed from the inside, and in breaking away the shell, there was revealed a pedicle tube of small diameter extending along the posterior side to the apex. The lower part was full of clear calcite; the upper portion seems to have been plugged with shelly matter. The surface appears to have been covered with raised, concentric, linear ridges.

Remarks.

This species is referred to *Acrosaccus* rather than to *Acrothele* because of its evident similarity to *Acrosaccus shuleri*. From that species it differs in having a lower pedicle valve with a wider apical angle.

Measurements: — The length and width are each 18 mm. The height is about 5 mm.

Horizon and Locality: — A single specimen was found in the Holston at the McNutt Quarry at Sharon Springs, Va., and is no 8592 in the M. C. Z.

Superfamily CRANIACEA Waagen

Family CRANIIDAE King.

Genus PETROCRANIA Raymond.

PETROCRANIA PRONA Raymond.

Plate 1, fig. 6.

Crania prona Raymond, Ann. Carnegie mus. 1906, **3**, p. 574.

Petrocrania prona Raymond, Ann. Carnegie mus., 1911, **7**, p. 229, pl. 34, fig. 26-31.

The ventral valve is not present in the material under discussion, but several more or less complete brachial valves are available giving a fair idea of both surfaces. This shell is of a squarish outline and low, highest about one-third the way forward from the posterior margin. The surface markings are concentric, lamellose growth lines. The interior shows two prominent scars of the anterior adductors just behind the centre, with small ones posterior to these, which represent the hinder adductors. In the anterior part of the interior of the valves may be seen traces of the vascular sinuses, but poorly preserved in the material on hand. The dimensions are: length 16 mm., width 15.5 mm., length-width index 103. It is distinguished from *P. ulrichi* in the more posterior position of the muscle-scars.

Horizon and Locality: — Ottosee, above the lowest marble at the quarry north of Luttrell, Tenn.— Holston, base, at Hoge Farm, Bland Co., Va. (doubtful identity).— Chazy, Valcour Id. and Chazy, N. Y. Figured specimen no. 8589, M. C. Z.

PETROCRANIA CICATRICULA, sp. nov.

Plate 3, fig. 4.

The species is represented by brachial valves which differ from others of the genus in being very convex and rounded, almost hemi-

spherical, with a slight depression extending from the anterior margin half way to the back. The interior shows very faint circular impressions of the anterior adductors and some traces of the vascular sinuses anterior to these, with a medial ridge corresponding to the external depression. Dimensions are: length 14 mm., width 14 mm., length-width index 100.

Horizon and Locality: — Ottosee, base of shale above the lowest marble at quarry north of Luttrell, Tenn. Holotype no. 8590 in the M. C. Z.

Order PROTREMATA Beecher.
Superfamily ORTHACEA Walcott.
Family ORTHIDAE Woodward.
Genus ORTHIS Dalman.

ORTHIS DISPARILIS Conrad.

Orthis disparilis Conrad, Proc. acad. nat. sci. Philadelphia, 1843, 1, p. 331, 333.
Hall, Pal. N. Y., 1847, 1, p. 119, pl. 32, fig. 4a-c. Emmons, Amer. geol., 1855, 1, pt. 2, p. 194, pl. 9, fig. 4a-c. Hall, Geol. Wis., 1862, 1, p. 435. Billings, Geol. Canada, 1863, p. 130, fig. 60.

The species is represented in the material under discussion by small shells, having the brachial valve flat and the pedicle valve strongly convex to almost triangular in cross section. They are marked by thirty to thirty-two simple, sharp plications averaging six to a space of five millimeters along the anterior margin. The cardinal area is high, concave, with a large delthyrium. The hinge-line is long. The size is slightly variable, but an average, well-preserved specimen has the following dimensions: width 15 mm., length 14 mm., height 7 mm. length of hinge-line 14 mm. The greatest width is just anterior to the highest point of the pedicle valve. The length-width index is 93. This shell would be placed with *Orthis tricenaria* as generally understood, but probably sufficient difference is found to make it advisable to revive Conrad's species, *O. disparilis*. It is smaller than *O. tricenaria*, and it is upon this distinction, that the species is based, although in other points the two are similar. Comparing this with *O. costalis*, it is readily distinguished by its smaller size and pointed cardinal angles.

Horizon and Locality: — Rare in the Ottosee at Fugates Hill, Va., at base of Ottosee north of Luttrell, and between second and third marbles near Chesney, Tenn.; also in the Tellico at South Knoxville, Tenn. It was originally described from the Black River formation at Mineral Point, Wis.

Genus PLECTORTHIS Hall and Clarke.

PLECTORTHIS EXFOLIATA Raymond.

Hebertella exfoliata Raymond, Amer. jour. sci., 1905, ser. 4, **20**, p. 370.

Plectorthis exfoliata Raymond, Ann. Carnegie mus., 1911, **7**, p. 238, pl. 35, fig. 11, 12.

This is one of the small Orthids, which helps in distinguishing it from others. Both valves are convex and rounded, showing suggestions of a fold in the pedicle valve and an equally vague trace of a sinus in the brachial. The plications are rather rounded with an occasional bifurcation, and in some individuals, a noticeable variation in point of size. Usually, there are from eight to ten in a space of five millimeters as measured along the anterior margin, there being in all from thirty to forty on each valve. The dimensions are: width 16 mm., length 13 mm., height 5 mm., length-width index 81. The greatest width is at a point about one-sixth of the distance from the hinge-line.

Horizon and Locality: — Comparatively rare in the Ottosee toward the middle, north of Mendota, Va., and in the lower part north of Luttrell, Tenn. Also reported from Chazy (Day Point), Chazy, Valcour, and Valcour Island, N. Y. and Isle La Motte, Vt.

PLECTORTHIS HOLDENI, sp. nov.

Plate 1, fig. 5.

Shell small, biconvex, wider than long, with simple plications. The hinge-width is less than that further forward, and the cardinal areas of both valves are low. The brachial valve is evenly convex, the pedicle valve somewhat flattened in front of the umbo. Each valve has from 20 to 24 plications, those along the middle conspicuously larger than those near the hinge, there being a gradual diminution in size from the median line backward.

Only separated valves have so far been found. The holotype, a pedicle valve, is 10 mm. long, 13 mm. wide at the hinge and 15 mm. in greatest width. No larger individual has been seen, but somewhat smaller ones are quite common.

This species is closely allied to *Plectorthis trentonensis* Foerste, but differs in having the plications along the middle of the shell very much larger than those at the sides.

Horizon and Locality: — Several specimens were found near the base of the Holston limestone at Speers Ferry, Va. Holotype no. 8595, M. C. Z.

Genus *HEBERTELLA* Hall and Clarke.*HEBERTELLA MELONICA*, sp. nov.

Plate 1, figs. 8, 9.

Shell transversely oval in outline, the two valves about equally convex, covered with fine striae which increase by both bifurcation and implantation. The hinge-width is considerably less than the greatest width, and the cardinal area of the pedicle valve is of median height for the genus, nearly flat, but gently concave under the beak; that of the brachial valve is about half the height of the opposite area, and decidedly concave. The delthyrium is narrow.

The interior of the pedicle valve displays a prominent muscle-scar extending nearly one-third of the length of the shell toward the anterior margin, and of equal width and length (6.5 mm.). It is trilobate, the two exterior lobes, representing the attachments of the diductors, are equal; the intermediate lobe which forms the attachment of the adductors is on the summit of a narrow ridge rising to an abrupt prominence at the anterior edge of the scar. The whole is slightly elevated above the general surface. In front of the muscular area is a shield-shaped region, pointed toward the front, outlined on either side by a wide, well-impressed vascular sinus, which, near the front, breaks up into a number of short distributaries. The surface of this shield and of other areas outside the sini, is covered with elongated papilli. The anterior margin of the shell is nearly straight, but it may be slightly concave along the middle. Dimensions are: width 27 mm., length 24.5 mm., width at hinge line 20 mm., length-width index 91. The point of greatest width lies about half way back from the anterior margin. In a space of five millimeters at the anterior margin there are usually eleven striations. The fineness of the striations distinguishes the species from *Hebertella borealis*; *Hebertella frankfortensis* is about equal to it in size, but has coarser striations and a higher cardinal area. *H. maria-parkensis* has a much lower length-width index. *H. melonica* is larger than *H. nickelsi* and does not have a pointed anterior margin, and the same features serve to distinguish it from *H. rogerensis*. It is larger and has finer striations and more prominent growth lines than *H. vulgaris*.

Horizon and Locality: — Ottosee at Fugates Hill north of Mendota, Va.; north of Luttrell, and between the second and third marbles near Chesney, Tenn. The species is also present in the Holston at the

McNutt Quarry, Sharon Springs, Va. Holotype no. 8596 in the M. C. Z.

HEBERTELLA VULGARIS Raymond.

Orthis perveta Billings (not Conrad), Canadian nat. and geol., 1859, **4**, p. 434, fig. 10.

Orthis subaequata Billings (not Billings, 1856), Canadian nat. and geol., 1859, p. 434.

Orthis gibbosa Billings, Canadian nat. and geol., **4**, 1859, p. 434.

Hebertella vulgaris Raymond, Ann. Carnegie mus., 1906, **3**, p. 501; *ibid.*, 1911, **7**, no. 2, p. 242, text figs. 15-18, p. 246, fig. 22, pl. 36, figs. 2-5.

The species seems, from the abundance of the material, to be fairly common in the Holston. As previously described, the form occurs both as large and small individuals; those under consideration seem to be all of the lesser size. The convexity of the shells is about equal, although a very slight sinus is sometimes present in the brachial valve. Growth lines are few, and striae increase by bifurcation and implantation. The dimensions are: length 18 mm., width 22 mm., length-width index 82. In a space of five millimeters along the anterior margin are found ten striations. It is distinguished from *H. borealis* by its greater width, and it is smaller and less gibbous than *H. melonica*.

A few specimens referable to this species have been found in the Ottosee. From the exteriors alone they are not easily separable from *Pionodema globosa*, but the interiors of two pedicle valves show the characteristic muscle-areas and vascular sini of Hebertella. An interior of a brachial valve shows the thin cardinal process on a platform supported by the median septum, as in specimens from Valcour Island, N. Y.

Horizon and Locality: — Holston, base of reef, Hoge Farm, Bland County, Va., and McNutt Quarry, Sharon Springs, Va. Also in the Chazyan at Chazy and Valcour Island, N. Y., and in Canada. In the Ottosee at the base of the shale above the lowest marble in a quarry to the north of Luttrell and between the second and third marbles near Chesney, Tenn. Also in the Lenoir in the Catawba Valley, Va., are found specimens which may be of this species.

Genus GLYPTORTHIS Foerste.

GLYPTORTHIS BELLARUGOSA (Conrad).

Orthis bellarugosa Conrad, Proc. acad. nat. sci. Philadelphia, 1843, **1**, p. 333. Hall, Pal. N. Y., 1847, **1**, p. 118, pl. 32, fig. 3a-e. Emmons, Amer. geol. 1855, **1**, pt. 2, p. 197, pl. 9, fig. 3a-d. Shaler, Mem. geol. surv. Ky., 1876, **1**, p. 35.

- Hebertella bellarugosa* Hall and Clarke, Pal. N. Y., 1892, **8**, pt. 1, p. 222. Grabau and Shimer, N. Am. index fossils, 1907, **1**, p. 255, figs. 304d-e. Raymond, Ann. Carnegie mus., 1911, **7**, p. 245, text figs. 19, 20, pl. 36, figs. 8, 9.
- Orthis (Hebertella?) bellarugosa* Winchell and Schuchert, Geol. Minn., 1893, **3** pt. 1, p. 434, pl. 33, figs. 1-4. Schuchert, Proc. U. S. nat. mus., 1900, **22**, p. 157.
- Glyptorthis bellarugosa* Foerste, Bull. sci. lab. Denison univ., 1914, **17**, p. 258 (gen. ref.).

The species is rare in this area, only two individuals having been found thus far whose identity is unquestionably proved. The shell is small with valves nearly equal in convexity, the brachial having a mere suggestion of a sinus. The hinge line is straight, and the cardinal area relatively large. The most striking feature and the one which distinguishes this form from all other genera of the Orthidae is the pattern of the surface markings. In it the radiating striae are crossed by concentric growth lines in such a fashion as to give a scalloped, or imbricating effect. The dimensions are: width 11 mm., length 9 mm., height 5.5 mm., length of hinge line 8.5 mm., length-width index 82. In a space of five millimeters along the anterior margin there are eleven striations.

Horizon and Locality:—The specimens are from the Ottosee at Liberty Hill and at a point 100 feet below the Moccasin between Chesney and Luttrell, Tenn. Also reported from Black River formation at Mineral Point, Janesville, Neenah, etc., Wis., Minneapolis, St. Paul, Cannon Falls, etc., Minn., Decorah and McGregor, Iowa, Curdsville, Ky. and Baffin Land. It is common in the Ridley in central Tennessee and in the middle Chazy of the Champlain Valley.

Subfamily DALMANELLINAE Schuchert
Genus DALMANELLA Hall and Clarke.

DALMANELLA ROGATA (Sardeson).

- Orthis rogata* Sardeson, Bull. Minn. acad. nat. sci., 1892, **3**, p. 331, pl. 5, figs. 1-4. Amer. geol. 1897, **19**, p. 95, pl. 4, figs. 1-10.
- Orthis (Dalmanella) testudinaria* Hall and Clarke, Pal. N. Y., 1892, **8**, pt. 1, pl. 5B, figs. 27-31. Winchell and Schuchert, Geol. Minn., 1893, **3**, pt. 1, p. 441, pl. 33, figs. 17-22.

The shell is small, nearly circular in outline, with a hinge line less than the greatest width. The pedicle valve is convex, with a relatively high umbo continued anteriorly in a ridge which widens and merges into the general contour of the shell half way to the margin. The

brachial valve is nearly flat with a more or less ill-defined sinus. The surface is ornamented with fine, radiating striae showing a slight irregularity in spacing. The dimensions are: width 12.5 mm., length 11.5 mm., height 5 mm., width at hinge line 7.5 mm. The length-width index is 92. At a point midway between the hinge line and the anterior margin is the greatest width of the shell. The brachial valve is somewhat more convex than in most of the Trenton representatives of this species. The species is distinguished from *Dalmanella bassleri* and *D. fertilis* in being much smaller. It is, on the other hand, nearly twice as large as *D. hamburgensis*. It lacks the concentric lines of growth seen in *D. testudinaria* and the striations are much finer.

Horizon and Locality: — Ottosee at Liberty Hill, Tenn., where it is common, and in the Black River and Trenton at numerous localities in North America.

Family RHIPIDOMELLIDAE Schuchert.

Subfamily PLAESIOMINAE Schuchert.

Genus PLAESIOMYS Hall and Clarke.

PLAESIOMYS PLATYS (Billings.)

Plate 1, figs. 10, 11.

Orthis platys Billings, Canadian nat. and geol. 1859, 4, p. 438, figs. 15a-c.

Geol. Canada, 1863, p. 129, figs. 54a-c. Hall and Clarke, Pal. N. Y., 1892,

8, pt. 1, p. 218. Winchell and Schuchert, Geol. Minn., 1893, 3, pt. 1, p. 424.

Dinorthis platys Schuchert, Bull. U.S.G.S., 1897, 87, p. 216.

Plaesiomys platys Raymond, Ann. Carnegie mus., 1911, 7, p. 238, pl. 35, figs. 13-14.

As generally encountered, this is a rather small form, usually not exceeding twenty-five millimeters in width, but a few individuals are met that reach a width of between thirty and thirty-five millimeters, though the smaller forms seem to be more typical of the fauna under analysis. The pedicle valve is convex at the umbo giving way to a plane or slightly concave area anteriorly. The brachial valve is well-rounded and convex with a slight medial depression toward the anterior margin and strong depressions just in front of the posterior edges of the shell. The posterior edges above the hinge line may show a tendency to turn up in a ridge extending from the neighborhood of the delthyrium to the cardinal extremities. The hinge line of the adult is nearly equal to the greatest width of the shell. Young individuals have

the greatest width at the hinge. The surface markings are fine, well-defined striations. The cardinal area is long and narrow. The interior of the pedicle valve bears a small, poorly-defined muscle-scar, the brachial having a pronounced, though short, cardinal process. Dimensions of an average individual are: width 33.5 mm., length 27 mm., height 9 mm., length of hinge line 29.5 mm., length-width index 83. In a space of five millimeters on the anterior margin are found nine striations. The species may be distinguished from *Plaesiomys deflecta* by its large size and much less convex brachial valve, whereas its plications are much finer and the cardinal extremities more extended than in *D. ulrichi*.

Horizon and Locality: — Ottosee at Fugates Hill, and Speers Ferry, Va., and in Tennessee between the second and third marbles near Chesney, 100 feet below the Lowville between Chesney and Luttrell, north of Luttrell, and at Liberty Hill. Also reported in the Chazy at Montreal, Quebec; Crown Point, Valcour Island and Chazy, N. Y. and in eastern Tennessee (Lenoir). The species is found in the Holston formation at Fountain City, Luttrell, and at the Ross and Republic Quarry, 3 miles southeast of Knoxville, Tenn. At those localities it is well represented by fairly well-preserved specimens showing the characteristically fine striations and the extended cardinal extremities of the species. In the Lenoir of the Catawba Valley, Va., many specimens of this species are found. Figured specimens nos. 8598 and 8599, M. C. Z.

PLAESIOMYS ELONGATA, sp. nov.

Plate 1, figs. 15, 16.

The species is rather closely allied to *Plaesiomys platys*, but is longer in proportion to the width, the pedicle valve is more convex throughout, and the brachial valve lacks the medial and lateral depressions found in the species described above. The brachial valve is more convex than in *P. platys*, and its anterior end shows a cardinal process that is short and rhombic in shape. The interior of the pedicle valve bears a bilobate muscle-scar, distinct but not large. The striations are fine and distinct, while concentric growth lines may or may not be a prominent feature on the valves. The dimensions are: width 23 mm., length 21.5 mm., height 11.5 mm., length of hinge line 20.5 mm., length-width index 93. In a space of five millimeters on the anterior margin are found ten striations.

Horizon and Locality: — Ottosee at Liberty Hill, north of Luttrell, Tenn. Holotype no. 8601, M. C. Z.

PLAESIOMYS BREVIS, sp. nov.

Plate 1, figs. 12, 14.

Shell similar in all respects to *Plaesiomys platys*, but with much shorter valves, the index varying from 61 for a young shell, 10.5 mm., long to 64 for an adult 18 mm. in length. The greatest width is at the hinge in nearly all specimens, but the angles become rounded on some adults.

Horizon and Locality: — This is a common species in the Ottosee at Fugates Hill north of Mendota, Va., and there is a single specimen from the top of the Ottosee 5 miles northwest of Rogersville, Tenn. Cotypes no. 8600, M. C. Z.

Genus DINORTHIS Hall and Clarke.

DINORTHIS PECTINELLA (Emmons).

Orthis pectinella Emmons, Geol. N. Y. rept. 2nd dist., 1842, p. 394, fig. 2. Owen, Amer. jour. sci. and arts, 1844, **47**, p. 366, fig. 2. Hall, Pal. N. Y. 1847, **1**, p. 123, pl. 32, figs. 10, 10c. Emmons, Amer. geology, 1855, **1**, pt. 2, p. 193, pl. 9, figs. 10, 11a, b. Billings, Canadian nat. geol., 1857, **1**, p. 205, fig. 602. Geol. Canada, 1863, p. 165, fig. 147a-c. Chapman, Canadian jour., 1862, n.s., **7**, p. 111, fig. 92; *ibid.*, 1863, **8**, p. 199, fig. 184. Expos. Min., geol. Canada, 1864, p. 115, fig. 91, p. 171, fig. 183. Chamberlin, Geol. Wis., 1883, **1**, p. 155, figs. f and g.

Dinorthis pectinella Hall and Clarke, Pal. N. Y. 1892, **3**, pt. 1, pp. 195, 222, 228, pl. 5, figs. 29-33. Weller, Geol. surv. N. J., Rept. on palaeontology, 1903, **3**, p. 154, pl. 9, figs. 29-30. Grabau and Shimer, N. A. Index fossils, 1909, **1**, p. 253, fig. 303 i-l. Bassler, Bull. 2A, Va. geol. surv., 1909, pl. 24, fig. 2.

Orthis (Dinorthis) pectinella Winchell and Schuchert, Minn. geol. surv., 1893, **3**, pt. 1, p. 424, pl. 32, figs. 31-34. Whiteaves, Geol. surv. Canada, Pal. fossils, 1897, **3**, pt. 3, p. 175.

Orthis charlottae Winchell, 8th rep. geol. nat. hist. surv. Minn., 1880, p. 67.

This species is typically resupinate. The pedicle valve commences at the umbo in a raised portion, falling rapidly away to a plane or even slightly concave area extending to the anterior margin. The brachial valve is somewhat strongly convex throughout. The cardinal extremities are slightly rounded, and the cardinal area and delthyrium small. Plications to the number of thirty-six ornament the surface and are strong, sharp and simple. Some variations are seen in the plications of forms which have been referred to this species and are worthy of note.

The type of Emmons (Geol. N. Y. rep. 2nd dist. 1843, p. 394, fig. 2) is an individual with strong, equal plications. Some individuals from the Trenton correspond to this, but at the same locality are found others which show successive gradations into types which have the plications all bifurcated at the anterior margin, or have lesser plications implanted between the major ones, sometimes extending to the umbo. Doubtless, although there appears to be intergrading, specific rank should be assigned to the two extremes, and it is here proposed to restrict Emmons's species to forms having simple, undivided plications.

On the brachial valve the plications appear somewhat rounded, but are more or less flattened on the pedicle valve. The interior of the pedicle valve bears a pair of prominent teeth and a rather elevated muscle-scar, the adductors being on a slightly raised median portion and the diductors large and lateral thereto. The plications are prominent on the interiors of both valves. The brachial valve shows a decided medial ridge and fairly large cardinal process. The dimensions: length 19 mm., width 24.5 mm., height 8 mm., length at hinge line 20 mm., length-width index 70. In a space of five millimeters on the anterior margin there are three plications. The shell is widest about one-third of the distance forward from the hinge line. The species may be differentiated from *Dinorthis* (*Valcouria*) *deflecta* Conrad as it is rather larger and has coarser plications and is more typically plano-convex. It is distinguished from *D. meedsi* Winchell and Schuchert, by its large size, coarse, simple plications and flatter pedicle valve.

Horizon and Locality: — This species is fairly common in the Ottosee east of Concord, Tenn., and near the base of the Ottosee at Luttrell, Tenn. It is reported from the Black River and early Trenton at Middleville, Trenton Falls, etc., N. Y., Pennsylvania, Mercer County, Ky., Ontario, Decorah, Ia., St. Paul, Minn., Lake Winnipeg, Canada, Tenn. and Va. The species is found in the *Dinorthis* zone of the Holston west of Blacksburg, Va., in the continuation of the same beds near Goodwin's Ferry, New River, and at the top of the reef at the Hoge Farm, Bland County, Va. In the former of these localities it is an extremely abundant, silicified fossil, showing in great profusion on the weathered, red-brown surfaces of the rock. Here are found excellent specimens showing the coarse plications and the plano-convexity of the valves, the pedicle valve being flatter than in most cases. This brachiopod has also been found in the Lenoir in the Catawba Valley, Va., north of Salem, and in a shaly layer in the Holston in a cutting on the Clinchfield Railroad just north of Copper River between Speers Ferry and Clinchfield, Va.

DINORTHIS ATAVOIDES, sp. nov.

Plate 2, fig. 4.

Shell large, transversely oval in outline, the valves subequally convex. Cardinal areas nearly equal and both extremely low.

The pedicle valve is depressed convex for nearly half its length, then becomes flattened in the middle of the front and merges into a shallow, median sinus. The brachial valve is evenly convex throughout and shows no trace of fold or sinus. Surface crossed by from 32 to 36 strong, simple plications which are of about the same width as the furrows between them. The interior of the pedicle valve shows muscle-scars of the usual form for *Dinorthis*.

The holotype is 21 mm. long, 20 mm. wide at the hinge, and 30 mm. wide at the mid-length. The index varies on the shells measured from 67 to 70.

This species differs from *Dinorthis pectinella* in being wider and having a more convex pedicle valve. It is more nearly of the proportions of *D. semioralis* (Hall) (Pal. N. Y., 1847, 1, p. 124, pl. 32, fig. 11), but has a shorter hinge, lower cardinal areas, and more convex pedicle valve. The latter is the most notable feature of this species, and indicates that during the earlier stages of growth the shell must have had the form of a *Plectorthis*.

Horizon and Locality:—Several specimens were found in a shaly layer in the Holston limestone in a cutting on the Clinchfield Railroad north of Copper Creek between Speers Ferry and Clinchport, Va. Holotype and paratype nos. 8605 and 8606 in the M. C. Z.

DINORTHIS INTERSTRIATA, nom. nov.

Dinorthis pectinella Hall (not Emmons), 2nd Ann. rept. N. Y. state geologist, 1883, pl. 34, figs. 39–40. Hall and Clarke, Pal. N. Y., 1892, 8, pt. 1, pl. 5, figs. 27, 28.

This form has been considered to be identical with *D. pectinella*, but it is distinguished from it for the reason that between each pair of plications is a pair of finer striae. Perhaps, as in the case of certain varieties of *D. pectinella* already noted, it may in time be shown from the collection of additional material, that this form intergrades with the latter; but at present no such series is known. Therefore, a new name is proposed. The form has already been figured under *D. pectinella*. It is shown in the present faunas by a pedicle valve only. Dimensions are: length 19 mm., width 25 mm., length of hinge line 21 mm., length-

width index 76. In a space of five millimeters along the anterior border are four plications. The greatest width is about one-third the way back from the anterior margin.

Horizon and Locality: — Ottosee, Fugates Hill, Va., Trenton limestone, Lewis Co., N. Y. Type in the New York State Museum.

DINORTHIS QUADRIPLICATA, sp. nov.

Plate 1, fig. 13; plate 3, figs. 5, 6.

Shell resupinate, nearly planoconvex, with very low, subequal cardinal areas. Pedicle valve convex only at the beak, flat or slightly concave in front, with a very broad and shallow sinus. Brachial valve evenly convex, without fold or sinus. Hinge width somewhat less than that below, the cardinal angles rounded. Surface of both valves marked by from 25 to 30 large plications, 4, or occasionally 5 of which in the middle, are broader than the others, and simple, whereas those at the sides nearly all bifurcate once or twice.

The holotype is 18.5 mm. long, 19 mm. wide at the hinge, and 24 mm. in greatest width: index, 77.

This shell has the same size and proportions as the typical *Dinorthis pectinella*, but differs in having only the median plications simple. The undivided nature of these same plications differentiates it from *D. interstriata*.

Horizon and Locality: — A rather common shell in the Ottosee at Fugates Hill, north of Mendota, and at Speers Ferry, Va., and in the Ottosee just above the Holston at Luttrell, Tenn. Holotype no. S602 in the M. C. Z.

DINORTHIS TRANSVERSA, sp. nov.

Plate 2, figs. 1, 2, 6.

Shell nearly planoconvex, transversely oval in outline. Pedicle valve only slightly elevated at the back, otherwise nearly flat, but with a very slight fold mesally. Brachial valve depressed convex, with a broad median sinus which becomes narrow on the umbo and disappears at the beak. The surface of both valves is covered with rather coarse plications which increase in size toward the median line. Nearly all bifurcate at least once, and as adjacent ones do so at various distances from the beak, an irregular pattern results. The holotype is 19 mm. long, 22 mm. wide at the hinge line and 30 mm. in greatest width. The index is 63. A somewhat larger pedicle valve is 20.5 mm. long.

This species is most closely allied to *Dinorthis quadriplicata*, but differs in that the median as well as the outer plications bifurcate, the shell is wider, hence the index is lower, and there is a sinus in the brachial and a fold in the pedicle valve.

Horizon and Locality: — A single specimen was found in the lower part of the Ottosee at Luttrell, Tenn., and two pedicle valves at a similar horizon at Fugates Hill, north of Mendota, Va. The holotype is no. 8603, M. C. Z., and the paratype 8604.

Genus NICOLELLA Reed.

NICOLELLA AGILERA, sp. nov.

Plate 3, fig. 7.

Shell concavo-convex, widest at the hinge, covered with coarse striae or relatively small plications which increase by bifurcation on the brachial and implantation on the pedicle valve. Pedicle valve convex, highest at the umbo, with concave slopes to the cardinal extremities. Brachial valve gently concave. The holotype, a pedicle valve, is 15 mm. long and 23 mm. wide at the hinge, the index being 65. At the front there are 4 large and 3 secondary striae in a space of 5 mm.

This species differs from *Nicolella actoniae* (Sowerby), the type of the genus, in having smaller ribs which are not entirely simple, but increase by intercalation of somewhat weaker ones on the anterior half of the shell. In this respect it is more like *N. asteroida* Reed (Trans. Roy. soc. Edinburgh, 1917, 51, pt. 4, p. 860, pls. 10, 11), but that species lacks the alate cardinal extremities.

Horizon and Locality: — Two specimens were found in the Holston at the McNutt Quarry, Sharon Springs, Va., and are nos. 8607 and 8608 in the M. C. Z.

Genus PIONODEMA Foerste.

Some discussion as to the classification of this genus has taken place in the past, and in order to show all its supposed relations, a summary of the different opinions is given below.

Foerste (Bull. sci. lab. Denison univ., 1909, 14, p. 221) proposed Bathycoelia as a subgenus of Dalmanella. His generic description follows: "*Dalmanella bellula* belongs to the group of Dalmanellas, typified by *Dalmanella subaequata* Conrad, in which the brachial valve is strongly convex, and the median depression is absent or only faintly

indicated. This group appears to have had a phylogenetic history distinct from the group typified by *Dalmanella testudinaria*. It ranges from the Stones river to the Devonian. For the species included in this group, the term Bathycoelia is proposed as a subgeneric term." That is to say, Dalmanellas having a strongly convex brachial valve with little or no median depression, would be placed in this subgenus. Bathycoelia proving to be preoccupied, he substituted the term Pionodema in Bulletin of the Scientific Laboratory of Denison University, 1912, 17, p. 139, quoting as his type species *Pionodema subaequata* (Conrad).

In "A Textbook of Paleontology," Eastman-Zittel, 1913, p. 382, Pionodema is given the rank of a genus along with Plaesiomys under the subfamily Plaesiominae of the family Rhipidomellidae. Both the families are new and distinct from Dalmanella which is there placed in the new subfamily Dalmanellinae of the family Orthidae. Thus has this classification made the separation still more remote, for, when Foerste would have Pionodema merely a subgenus of Dalmanella, Schuchert classifies it not only as a different genus, but in another family and subfamily, their connections being only in remaining under the superfamily Orthacea. The chief distinction seems to be the punctate condition of the shell in Dalmanella and the impunctate shell of Pionodema.

PIONODEMA SUBAEQUATA (Conrad).

Orthis subaequata Conrad, Proc. acad. nat. sci. Philadelphia, 1843, 1, p. 333;
Hall, Pal. N. Y., 1847, 1, p. 118, pl. 32, figs. 2a-f.

See Bull. 92, U. S. nat. mus., 1915, 2, p. 978, for further synonymy.

There are four specimens in the collection which appear to belong to this species, differing from the other Pionodemas in the Ottosee in having a longer hinge and a shallow sinus in the pedicle valve. The smallest specimen is the most typical, and agrees in all respects with specimens figured by Winchell and Schuchert from Minnesota. It is 13 mm. long, 10 mm. wide at the hinge, and 15 mm. in greatest width, the index being 86. There are 15 striations in a space of 5 mm. at the front. The largest specimen had a shallower sinus in the pedicle valve. The length is 21 mm., the width at the hinge 17 mm., and the greatest width 24 mm., the index being 87.

Two of the three specimens referred to this species are slightly unsymmetrical, a condition also noticed among other members of this genus in the Ottosee. These specimens, when viewed from above,

looking down on the pedicle valves, have all the striations turned somewhat to the right.

Horizon and Locality: — Three specimens are from the Ottosee at Fugates Hill north of Mendota, Va., and one from east of Concord, Tenn.

PIONODEMA GLOBOSA, sp. nov.

Plate 2, fig. 5.

The shell presents a decidedly circular outline. The brachial valve is strongly convex, but shows, toward the cardinal extremities, marked depressions that are distinguishing marks of the species. On the internal surface a low-medial septum extends anteriorly about one-third the length of the valve. The pedicle valve is less convex than the brachial with a tendency to a flattened area toward the anterior margin, and a small, sharply curved beak. The cardinal area is small and well-defined, as also is the delthyrium, whereas the hinge line is considerably shorter than the greatest width of the shell. The interior shows a small, subcircular muscle-scar, plainly three-lobed with a short, raised process in front of the scar. The muscular area is like that of *Hebertella*, but, since the shell is thinner, less deeply impressed. The surface of the valves is marked by fine, simple striations and faint growth lines. The dimensions are: width 21 mm., length 18.5 mm., thickness 11 mm., length of hinge line 13.5 mm., length-width index 88. The greatest width of the shell is about half way between the anterior and posterior margins. In a space of five millimeters along the anterior border are found sixteen striations. The species is nearly related to *Pionodema perveta*, but there are differences which, if carefully noted, seem ample for distinguishing the form. Although of nearly equal size, the hinge line of *Pionodema amoena* (N. H. Winchell) is markedly longer than that of *P. globosa* and is shorter in the latter than in *P. perveta* (Conrad). The length is greater in proportion to the width, and the above mentioned depressions on the shoulders of the brachial valve, as present in the species, are absent in the last mentioned type. The species differs from *P. stonensis* (Safford) in the less convexity of the pedicle valve of that species, as well as in the arrangement of the striations.

Horizon and Locality: — At the top of the Ottosee formation five miles northwest of Rogersville, Tenn., and in the middle and upper parts at Fugates Hill, north of Mendota, also at Speers Ferry, Va., and at Liberty Hill, Tenn. Holotype no. 8609 in the M. C. Z.

PIONODEMA MINUSCULA, sp. nov.

Plate 2, fig. 3.

This is a *Pionodema subaequata* (Conrad) in miniature. Both valves are convex, the pedicle being the higher, with the raised umbo prominent and a small, triangular cardinal area in which is a narrow delthyrium. The surface is marked by fine striations and faint lines of growth. The dimensions are: width 13 mm., length 12 mm., thickness 7 mm., length at hinge line 9 mm., length-width index 92. In a space of five millimeters on the anterior margin are found some twenty-four striations. The greatest width is just in front of the umbo.

Horizon and Locality: — Lebanon formation at Lebanon, Tenn., and in the Holston at Concord, Tenn. Holotype from Lebanon, and no. S610 in the M. C. Z.

Superfamily STROPHOMENACEA Schuchert.

Family STROPHOMENIDAE King.

Subfamily RAFINESQUININAE Schuchert.

Genus PLECTAMBONITES Pander.

PLECTAMBONITES CURDSVILLENSIS Foerste.

Plectambonites curdsvillensis Foerste, Bull. sci. lab. Denison univ., 1912, **17**, p. 122, pl. 10, figs. 15a-b.

The species, like most of the Ordovician representatives of the genus, has been referred to as *Plectambonites sericeus* (Sowerby). Winchell and Schuchert in their description of the latter species (Minn. geol. surv., 1893, **3**, pt. 1, p. 415), say "Surface of both valves marked by numerous, very minute, closely arranged, equal, radiating striae, or with every fourth, fifth or sixth one a little larger or more prominent than those between." Foerste based his species, *Plectambonites curdsvillensis*, seemingly on the accentuation of every fourth striation, for the remainder of his description varies little from that applicable to the old form.

The pedicle valve is strongly convex and the brachial correspondingly concave; the hinge line is the greatest width. The pedicle valve shows a prominent muscle-scar with two sharp, centrally located ridges extending well forward and increasing in elevation. The cardinal extremities are sharp. It differs from other species in the accentuation of every fourth striation. The dimensions are: width 13 mm., length

7 mm., height 2.5 mm., length of hinge line 13 mm., length width index 54. In a space of five millimeters on the anterior margin are found from twenty-five to thirty striations.

Horizon and Locality:—At base of Ottosee north of Luttrell, at Liberty Hill, and five miles northwest of Rogersville, Tenn.; at Fugates Hill, north of Mendota, Va.; from the Trenton (Curdsville), Glen Creek Station, Woodford County, Kentucky.

PLECTAMBONITES AEQUISTRIATUS, sp. nov.

Plate 3, figs. 8, 9.

It seems advisable to give a specific name to forms that might be called *P. sericeus* (Sowerby) by the old classification, but which have all the striations of equal size. The specimens in question are rather small, depressed convex, about two-thirds as long as wide, with the greatest width at the hinge, where the cardinal angles are extended into short spurs. There is considerable variation in the outline, some of the individuals being notably long, with an index of 71, whereas others are of the more usual form of *Plectambonites sericeus*, with the index as low as 60. The average index for six adults is 66.

The interior of a pedicle valve from the typical locality, Liberty Hill, shows small and very divergent muscle-scars, separated at the posterior ends by a low, rounded septum. The diductors are small, situated behind the adductors and partially excavated beneath a sort of concave platform under the beak. Near the front, parallel with the margin, the shell is thickened and crossed by radial furrows. The interior of the brachial valve is of the usual type, with a pair of sharp septa.

The surfaces of both valves are covered by very fine striae of uniform size. In a space of five millimeters along the anterior margin will be found thirty to thirty-five.

Horizon and Locality:—Ottosee, south of Chilhowie Park, Knoxville, and at Liberty Hill, Tenn. At top of Holston, Thomas farm, three miles east of Blacksburg, Va. Cotypes no. S611, M. C. Z.

PLECTAMBONITES PISUM Ruedemann.

Plectambonites pisum Ruedemann, Bull. N. Y. state museum, 1902, p. 19, pl. 1, figs. 8–20. Bassler, Bull. Va. geol. surv., 1909, 2a, pl. 3, figs. 17–18.

The form is of rather infrequent occurrence in the region under consideration. Its shell is very small, and nearly semicircular in outline, strongly concavo-convex, with the pedicle valve very high, nearly hemispherical. The cardinal extremities are more or less prominent.

The surface markings are fine, radiating striae and concentric growth lines. The hinge line is the greatest width of the shell. The pedicle valve slopes abruptly with a fairly large cardinal area and a good sized delthyrium. The interiors of the valves are not shown by the available specimens. The dimensions are: width 10 mm., length 7.5 mm., length of hinge line 10 mm., length-width index 75. In a space of five millimeters along the anterior margin are found as many as fifty striations. The form is distinguished from others of the genus by its small size and gibbosity and is slightly smaller than the specimen from New York figured by Ruedemann.

Horizon and Locality: — This species was described originally from the Mohawkian of Ryседорф Hill and Moordener Kill, N. Y. (Ryседорф); it occurs also in the Chambersburg of Penna., Md., and Va. Specimens have been collected at the top of the Holston at the Thomas Farm three miles east of Blacksburg, Va.

PLECTAMBONITES TRISEPTATUS, sp. nov.

Plate 2, figs. 7, 8.

A rather large, thick-shelled species, with about the usual proportions of the so-called *Plectambonites sericeus*. The greatest width is at the hinge, the cardinal angles pointed in the young, but rounded in the adult. Surface covered with fine striae of alternating size, usually only one very fine one between each pair of the more prominent ones.

The scars of the diductors in the pedicle valve are strongly divergent, but not bounded mesially by ridges, and instead of being excavated in the shell, are built up as rounded callosities at the front. In old individuals these are very conspicuous, and extend nearly to the front of the shell. The most notable feature of the species, however, is the presence of a high, sharp-crested median septum in the brachial valve, extending beyond the anterior margin of the muscle-scars. On either side, diverging slightly from the median septum, is a very low, narrow septum bounding the inner edge of the adductor scar. On some individuals these septa are so poorly developed as to be hardly visible.

A large pedicle valve is 13 mm. long and 20 mm. wide at the hinge. A brachial valve, one of the cotypes, is 12 mm. long and 22 mm. wide at the hinge line.

The presence of a median septum in the brachial valve differentiates this species from all allied forms.

Horizon and Locality: — The holotype, no 8613, and paratype, no. 8614, are from silicified blocks from the Holston near Goodwins Ferry on New River, Va.

PLECTAMBONITES CRASSUS, sp. nov.

Plate 3, fig. 10.

Shell very large for a *Plectambonites*, strongly concavo-convex, with the highest part of the pedicle valve usually in front of the middle. Greatest width at the hinge, cardinal angles usually bluntly rounded, but in some cases auriculate. The surface is covered with fine striations, of two sizes, the prominent ones being rather distant and separated by bands of 10 or 12 very slightly elevated, extremely narrow threads. The most remarkable feature of the species is the fact that the coarse striations are really in pairs.

The largest individual in the collection is 17 mm. long and 28 mm. wide. A more common size is 16 by 26 mm. The index is about 61.

Horizon and Locality: — Holston at the McNutt Quarry, Sharon Springs, Va. Holotype no. 8616 in the M. C. Z.

PLECTAMBONITES NEGRITUS, sp. nov.

Plate 3, fig. 13.

The form is scantily represented as a diminutive *Plectambonites*. It is more nearly semicircular than other small members of the genus, with the lateral slopes of the pedicle valve flattened, the central portion rather high and curving steeply down to the hinge line. The brachial valve is not strongly concave, but rather flat. Surface markings consist of very fine striations with every sixth or seventh accentuated. Its small size and peculiarly curved pedicle valve together with the low index distinguish it from other species. Dimensions are: length 4 mm., width 8 mm., length-width index 50. The greatest width is at the hinge line. In a space of five millimeters along the anterior margin are 45 to 50 striations.

Horizon and Locality: — Lenoir, Catawba Valley, Va.; Holston, So. Knoxville, Tenn. Holotype no. 8615 in the M. C. Z.

Genus LEPTAENA Dalman.

LEPTAENA PALUSTRIS, sp. nov.

Plate 3, fig. 14.

The species resembles rather closely a small *Leptaena incrassata*, but is more nearly semi-circular in outline. It is known from a single specimen, a strongly convex pedicle valve, sharply deflected, with a raised

area forward and very fine, alternating striae, more or less obscured by exfoliation. There are only about 8 prominent striae. The surface is covered with fine pitting, and there are obscure, concentric undulations on the umbonal region. The dimensions are: length 7 mm., width 11 mm., length-width index 63. The greatest width is at the hinge.

Horizon and Locality:—Holston, Concord, Tennessee. Holotype no. 8619 in the M. C. Z.

LEPTAENA PRONA, sp. nov.

Plate 3, figs. 15, 16.

In general outline, the species is similar to *L. unicastata* (Meek and Worthen), found in the Richmond. It is also similar in size, having extended cardinal extremities and an abrupt deflection. Owing to the poor preservation of the single specimen, a pedicle valve, upon which the species is based, the amount of wrinkling is not known, but fine, radiating striae seem to have been present. The dimensions are: length 14.5 mm., width 27 mm., length-width index 54. The greatest width is at the hinge line.

Horizon and Locality:—Holston, Dinorthis zone, near Goodwins Ferry, New River, Va. Holotype no. 8620 in the M. C. Z.

Genus RAFINESQUINA Hall and Clarke.

RAFINESQUINA MINNESOTENSIS (N. H. Winchell).

?*Strophomena deltoidea* Owen (not Conrad), Geol. expl. Ia., Wis., and Ill., 1844, pl. 17, fig. 6 (not pl. 16, fig. 8).

Leptaena deltoidea Owen, Geol. rept. Wis. Ia., Minn., 1852, pl. 2B, fig. 10 (not the middle figure).

Strophomena incrassata Hall (not of 1847), Geol. Wis., 1862, 1, p. 42, fig. 16. 2nd Ann. rept. N. Y. state geol., 1883, pl. 38, figs. 1-5.

Strophomena minnesotensis N. H. Winchell, 9th Ann. rep. geol. nat. hist. surv. Minn., 1881, p. 120.

Rafinesquina incrassata Hall and Clarke, Pal. N. Y., 1892, 8, pt. 1, pl. 7, figs. 1-5.

Rafinesquina minnesotensis Hall and Clarke, Pal. N. Y., 1892, 8, pt. 1, p. 283. Winchell and Schuchert, Geol. Minn., 1893, 3, pt. 1, p. 401, pl. 31, figs. 25-29. Grabau and Shimer, N. A. index fossils, 1909, 1, p. 212, fig. 252.

Although a rather common fossil from this area, the material on hand does not show more than one interior, that of a brachial valve;

but there seem to be ample data for identifying the species. The shells are semioval, concavo-convex, the convexity of the pedicle valve varying slightly to approach, at least in one case, *Leptaenoid* proportions. The cardinal area is long and narrow with a prominent deltidium and a tiny pore as pedicle opening. The hinge line is the greatest width of the shell. The single available interior is a poorly preserved brachial valve, which, however, shows a prominent ridge concentric to and just within the anterior and lateral margins. The surface is marked by fine striae alternating in size and crossed by concentric growth lines. The dimensions are: width 18 mm., length 17 mm., height 4 mm., length-width index 94. Length of hinge line is 18 mm. Along the anterior margin in a space of five millimeters are found from eighteen to twenty striations. The species is distinguished from others of the genus by its small size, its hemispheric shape, and the thickening of the brachial valve near the margin. It has a much higher index than *R. distans* Raymond, and lacks the external concentric ridge that is characteristic of *Leptaena incrassata* Hall.

Horizon and Locality: — Ottosee formation at Liberty Hill, north of Luttrell, Tenn., and at Fugates Hill north of Mendota, Va. It is also reported from the Black River at Minneapolis, etc., Minn., Beloit, Wis., Decorah, Ia., and Kentucky, and the Lebanon of various localities in central Tennessee. The species is found in the Holston, being recovered from a point near Tilsons Gap, Bland Co., Va., but it is a far less common fossil there than in the Ottosee as described above, and is poorly preserved so that there is some doubt as to its true identity. One more typical specimen was obtained from the top of the Holston at the Hoge Farm, Bland Co., Va.

RAFINESQUINA CHAMPLAINENSIS Raymond

Rafinesquina champlainensis Raymond, Bull. Amer. pal., 1902, **3**, no. 14, p. 37, pl. 18, figs. 5, 6; Ann. Carnegie mus., 1911, **7**, p. 233, figs. 6-9.

The species is represented among the material on hand by a single specimen from the Ottosee, indicative of its rarity in that formation, whereas more have been found in the Holston, as discussed below. The individual from the Ottosee shows only the exterior of the pedicle valve in a rather poor state of preservation. It is very strongly convex, although of even curvature, with slight rounding of the cardinal extremities, so that the hinge line is slightly shorter than the total width. The surface is marked by fine radiating striae, every third or fourth being accentuated, and with growth lines that vary in prominence.

Nothing can be determined as to the brachial valve or the interior of the pedicle valve. The species differs from others of the genus by the combined characters of large size and extreme ventricosity. The dimensions are: width 39.5 mm., length 32 mm., height 12.5 mm., length-width index 81, length of hinge line 37.5 mm. In a space of five millimeters along the anterior margin are found thirty-five to forty striations.

Horizon and Locality:—Ottosee (middle) north of Mendota, Va., and from the Chazy, Crown Point, Valcour Island, Bluff Point and Chazy, N. Y., Isle La Motte and South Hero, Vt.; eastern Tennessee (Lenoir). The form occurs in the Holston, being represented at the top of the reef at the Hoge Farm, Bland Co., and in the Dinorthis zone near Goodwins Ferry, New River, Va. In this case the identity is far more sure than with the former specimen, as they are typically large ventricose shells.

RAFINESQUINA DUPLISTRIATA, sp. nov.

Shell large, nearly as long as wide, almost plano-convex. Surface covered with fine, alternating striae, every other one of which is prominent. The width at the hinge is almost, but not quite, equal to the greatest width. Cardinal angles rounded. Adult individuals show a downward deflection parallel to the margin of the pedicle valve, but some millimeters behind it, and the interior of the brachial valve has a corresponding ridge.

The pedicle valve is evenly and only moderately convex. The interior shows large, flabellate, indistinctly rounded diductor scars, and between them the narrow adductors, situated on a low, double, median ridge, the anterior end of which is bifurcated. The brachial valve is nearly flat, but deflected at the front in old individuals. The two prongs of the cardinal processes are short, stout, with neatly circular faces for the attachment of muscles. The adductor scars in this valve are not deep, but large, and the interior of the shell is marked by two pairs of lateral linear ridges and an extended median one. The interior is much like that of the brachial valve of *R. minnesotensis*.

One pedicle valve is 43 mm. long and 45 mm. wide at the hinge. The largest individual is 52 mm. long. The index for fully grown specimens is about 95, but young individuals are not proportionally so long, and have an index as low as 90.

This species differs from *Rafinesquina minnesotensis* in its much greater size and less convexity, although the scars on the interior are much the same. The general appearance of the shell is that of many

of the forms now referred to *R. alternata*, but if that species be restricted to shells from the Trenton, the present species differs from it in having only one small striation between each pair of prominent ones, and in being proportionately longer.

Horizon and Locality: — This species is common in silicified layers in the Holston near Goodwins Ferry on New River, Va. and north of Copper Creek, between Speers Ferry and Clinchport, Va. It has also been found in the Holston at the Ross and Republic Quarry three miles southeast of Knoxville, Tenn. Several specimens have been obtained from the Ottosee at Luttrell, Tenn., and one from the same horizon at Fugates Hill, north of Mendota, Va. Cotypes nos. 8621 and 8622 in the M. C. Z.

RAFINESQUINA DISTANS Raymond.

Rafinesquina distans Raymond, Ann. Carnegie mus., 1906, **3**, p. 575; 1911, **7**, p. 234, pl. 35, fig. 1.

The species is represented by a few ill-preserved specimens. The valves are but slightly convex, resembling some *Plectambonites* in this respect, and small, being wide compared to the length, with the greatest width at the hinge line. The distinguishing feature in this species is the surface decoration which consists of about a dozen prominent, radiating striae with many very fine ones intermediate to them, together with equally delicate growth lines. The dimensions are: length 9 mm., width 14.5 mm., length-width index 62. In a space of five millimeters along the anterior margin are found three of the larger and about fifty of the smaller striations.

Horizon and Locality: — The species occur in the Holston at the McNutt Quarry, Sharon Springs, Va. The original specimens were from the Upper Chazy on Valcour Island, and the Middle Chazy at Crown Point, N. Y.

RAFINESQUINA GRANDISTRIATA, sp. nov.

Plate 2, fig. 11.

Shell small, widest at the hinge, nearly as long as wide. Surface covered with coarse, rounded striae which increase by both bifurcations and implantation, and generally show additions near the anterior margin. Cardinal areas very low, the extremities auriculate. The pedicle valve is moderately and evenly convex, the brachial valve nearly flat in the umbonal region, becoming somewhat concave toward the front. The type is 12 mm. long and 15 mm. wide, and most of the

specimens have almost these dimensions, with an index of 80. The species may easily be recognized by the lack of alternations in the striae and the small size.

Horizon and Locality: — A rather rare species in the Holston limestone at the McNutt Quarry at Sharon Springs, Va. Holotype no. 8623 in the M. C. Z.

Genus *PTYCHOLYPTUS*, nov.

Rafinesquininae allied to *Rafinesquina*, in which the thin shell is thrown into numerous transverse rugae which are confined to the spaces between the principal striae, and are not continuous, concentric folds, as in *Leptaena*. Type, *Ptychoglyptus virginiensis* sp. nov.

PTYCHOLYPTUS VIRGINIENSIS, sp. nov.

Plate 2, fig. 12.

Shell small, almost flat, widest at the hinge, nearly half as long as wide. The surface has from 10 to 14 radial striae, not all of which are primary. Between them are wide spaces each occupied by about 12 very narrow, rather indistinct striations, separated by sharply impressed furrows, narrower than themselves. The interspaces between principal striations are crossed by wave-like wrinkles, the crests about as wide but a little more rounded than the troughs. There are about 8 or 9 crests in 5 mm. on the anterior part of the shell. Each wave is steeper on the front than on the back slope, and all are arcuate, bowing backward toward the apex. The wrinkles of adjacent interspaces are occasionally practically continuous, but usually alternate, so that the crests of one abut against the troughs of the next. They seem more often to be continuous near the cardinal angles.

The pedicle valve is gently convex on the umbo, becoming flattened toward the anterior margin. The brachial valve is concave about the beak, flat in front. No interior has been seen.

This species closely resembles *Rafinesquina* ? *subarachnoidea* Reed (Trans. Royal soc. Edinburgh, 1917, 51, pt. 4, no. 26, p. 870, pl. 12, figs. 25-32a), but appears to be more alate, and has the entire surface covered by wrinkles and not the posterior portion only. Reed's species, and probably *Strophomena arachnoidea* Törnquist, are to be referred to the genus now described.

Horizon and Locality: — A common fossil in the Holston limestone at the McNutt Quarry at Sharon Springs, Va.; found also in the

Holston at South Knoxville, Tenn. Holotype no. 8626 and paratype no. 8627, M. C. Z.

PTYCHOGLYPTUS PULCHRUS (Butts.)

Playfairia ? pulchra Butts, Geol. surv. Alabama, special rept., 14, 1926, p. 102, pl. 10, fig. 15.

Butts has recently published a figure of a small shell about 5.5 mm. long and 11 mm. wide, which is obviously a *Ptychoglyptus*. It differs from the type of the genus in having less alate cardinal extremities and somewhat less prominent concentric wrinkles.

Horizon and Locality:—From the limestone at the base of the Athens at Pratts Ferry, Bibb Co., Ala.

Subfamily DAVIDSONINAE King.

Genus CHRISTIANIA Hall and Clarke.

CHRISTIANIA, sp. indet.

The genus is represented by a single individual showing an interior of the pedicle valve. Owing to the poor state of preservation, it has been considered inadvisable to assign it to a species, though it seems to resemble *C. subquadrata* Hall rather closely. The valve is strongly convex and has a very small cardinal process, the interior marked by a series of longitudinal ridges. The dimensions are about 16 mm. long by 12 mm. wide, but owing to the chipped condition of the edges, they cannot be accurately determined.

Horizon and Locality:—Ottosee, base of hill, Hoge Farm, Bland County, Va.

Subfamily ORTHOTHETINAE Waagen.

Genus STROPHOMENA Blainville.

STROPHOMENA FILITEXTA (Hall)

?*Producta incurvata* Shepard, Amer. jour. sci., 1838, **34**, p. 144, figs. 1, 2.

?*Orthis incurvata* Castelnau, Essai sur le syst. Sil. de l'Amérique Septentrionale, 1843, p. 38.

?*Strophomena convexa* Owen, Geol. expl. Ia., Wis., and Ill., 1844, p. 70, pl. 17, fig. 2.

Leptaena filitexta Hall, Pal. N. Y., 1847, **1**, p. 111, pl. 31B, fig. 3.

Strophomena filitexta Emmons, Amer. geol. 1855, **1**, pt. 2, p. 198, pl. 11, figs. 8a, 9c. Billings, Canadian nat. geol., 1857, **1**, p. 203, figs. 1, 2. Hall, 12 rep.

N. Y. state cab. nat. hist., 1859, p. 70. Billings, Geol. Canada, 1863, p. 164, figs. 142a-d. Hall and Clarke, Pal. N. Y., 1892, 8, pt. 1, p. 251, pl. 9, figs. 1-7, pl. 9A, figs. 11-14 (not figs. 10, 15).

Streptorhynchus filitexta Hall, 2nd Ann. rept. N. Y. state geol., 1883, pl. 39, figs. 1-7, pl. 42, figs. 11-14 (not figs. 10, 15).

Streptorhynchus convexum Sardeson, Bull. Minn. acad. nat. sci., 1892, 3, p. 343.

Strophomena incurvata Whiteaves, Geol. surv. Canada, Pal. foss., 1895, 3, pt. 2, p. 119. Raymond, Bull. amer. pal., 1902, 3, no. 14, p. 303, pl. 19, fig. 11.

Weller, Geol. surv. N. J. pal., 1903, 3, p. 150, pl. 9, figs. 16, 17. Grabau and Shimer, N. A. index fossils. 1909, 1, p. 223, figs. 271a-d. Foerste, Bull. sci. lab. Denison univ., 1912, 17, p. 24, pl. 11, figs. 7-9a-c.

The species is very abundant in the Ottosee fauna locally, the individuals recovered being generally a little smaller than the specimens usually described, but in other particulars agreeing with the published descriptions. They are semioval in outline with a long hinge line slightly exceeding the greatest width. The pedicle valve is convex at the umbo, becoming concave anteriorly and showing a subrhomboidal to oval muscle-scar surrounded by a low and narrow ridge rising laterally to the teeth. The cardinal area is relatively large with a prominent deltidium. The species has an evenly convex brachial valve with an indefinite medial septum on its anterior. Surface markings are fine, radiating striae and lines of growth, so that, quoting Hall (Pal. N. Y., 1847, p. 111): "This shell is characterized by its striae which are crossed by fine, elevated lines, giving the surface a textile or woven appearance, which is markedly characteristic in well-preserved specimens, and differs from any other species of this [Trenton] rock." The dimensions of the shell are: width 33 mm., length 25 mm., height 6 mm. length of hinge line 35 mm., length-width index 76. In a space of five millimeters along the anterior margin are found about 25 striae. As already noted, the striation-pattern is the chief means of distinguishing the form, especially from *S. vincina* Foerste in which the striations are all of about equal size.

Horizon and Locality: — Ottosee formation at Liberty Hill, Tenn., and at Fugates Hill, north of Mendota, Va. Common in the Stones River and Black-River horizons at Green Bay, Wis., and various localities in Minn., Ia., Ky., Tenn., Mo., Canada, etc.

STROPHOMENA TENNESSEENSIS, sp. nov.

Plate 2, figs. 17, 18.

This is a rather large shell resembling *S. filitexta* (Hall), *S. trentonensis* Winchell and Schuchert, *S. winchelli* Hall and Clarke and other

good sized *Strophomenas*, but it may be distinguished from them by its higher index, moderate convexity and low cardinal area, together with the peculiar curvature of the brachial valve. This valve increases in height from the hinge line to a point about three-fourths of the distance to the anterior margin, where it turns steeply down to the edges of the shell. The ascending portion is nearly plane, but shows toward its centre a slight depression. The pedicle valve has the characteristic double curvature of the genus. A long, narrow cardinal area is present, with a prominent deltidium.

The dimensions are: width 33 mm., length 33 mm., length of hinge line 32 mm., length-width index 100. In space of five millimeters along the anterior margin are found 15 regularly alternating striae. The interior of the pedicle valve shows unusually large diductor scars, with the adductors on a low ridge between them.

Horizon and Locality:—A rare fossil in the Ottosee formation at Fugates Hill north of Mendota, Virginia, and at Liberty Hill, Tenn. Cotypes nos. 8628 and 8629 in the M. C. Z.

STROPHOMENA INSPECIOSA, sp. nov.

Plate 2, fig. 13.

Shell small, less than three-fourths as long as wide, with a moderately convex brachial and nearly flat pedicle valve. The surface appears rather rough, because of strongly marked lines of growth and irregular radial undulations, some specimens showing an obscure sinus in the brachial valve. The striae are fine, and generally regularly alternating, with one less important striation between each pair of more prominent ones. The cardinal area is of medium height, with a wide deltidium; and the greatest width is at the hinge line.

No specimen from the typical locality, Liberty Hill, Tenn., shows the interior, but a pedicle valve from Fugates Hill, Va., which appears to be this species, has the large scar of the diductors divided medially by a low septum which extends a short distance in front of the scars, tapering to a fine point at the anterior end.

The holotype is 15 mm. long and 22 mm. wide, and a smaller individual is 12 mm. long and 17 mm. in width. The index is about 68 to 70. In a space of 5 mm. the holotype shows 18 striations on the anterior margin.

This species somewhat resembles the well-known *Strophomena billingsi* Winchell and Schuchert, but is a less regularly curved shell, and the striae are more distinctly alternating. *Strophomena scofieldi* Win-

chell and Schuchert is an equally rough appearing shell, but has a distinct fold and sinus and no septum in the pedicle valve. (Pal. of Minnesota, 1893, 1, pl. 31).

Horizon and Locality:— A rather uncommon fossil in the Ottosee at Liberty Hill, Tenn., and Fugates Hill, north of Mendota, Va. Holotype no. 8631 and paratype no. 8634 in the M. C. Z.

STROPHOMENA TENUITESTA, sp. nov.

Plate 2, figs. 15, 16.

Shell of medium size, thin, both valves nearly flat. The width at the hinge about equal to the greatest width. The surface is covered with fine, radial striae, a weak one regularly alternating with a more prominent one, all crossed by very closely spaced, concentric lines. The cardinal area is unusually narrow; the shell is very thin, and practically all of the specimens found are bilaterally unsymmetrical. This latter fact is due perhaps to the thinness of the shell and the consequent liability to injury.

The holotype is 32 mm. long and about 34 mm. in width. A somewhat smaller specimen is 27 mm. long and 30 mm. wide. The index appears to be about 90. This species resembles *Strophomena filitexta* but is less curved and has a very much narrower cardinal area.

Horizon and Locality:— A rather common fossil in a shaly zone in the Holston in the first cutting north of Copper River on the railroad between Speers Ferry and Clinchport, Va. Holotype no. 8630, M. C. Z.

Subfamily TRIPLECIINAE Schuchert.

Genus OXOPLECIA Wilson.

OXOPLECIA HOLSTONENSIS, sp. nov.

Plate 3, fig. 17.

Shell small, nearly circular in outline, with both valves so convex as to be almost globose. The hinge line is short, and the cardinal angles rounded. The pedicle valve has a small, concave, cardinal area, the delthyrium closed by a nearly flat deltidium. The brachial valve shows no area. The pedicle valve has a rather broad, not deep, flat-bottomed sinus beginning in front of the umbo, and there is a corresponding fold in the brachial valve. The surface is marked by small plications which extend on to the umbo, but seldom entirely to the beak. These are crossed by fine, numerous, concentric lines.

There appear to be four primary plications in the sinus and five on the fold, but frequently specimens are found with one or two more in either situation. The average individual appears to have about ten plications on either side of the fold and sinus, although some have as few as six.

One individual is 10 mm. long, 12 mm. wide, and 7.5 mm. wide at the hinge. Most of the specimens are about that size, although one 16 mm. wide was observed.

The species is most closely related to *Oxoplecchia simulatrix* (Bassler), which occurs in the Chambersburg of northern Virginia and south-eastern Pennsylvania (Maryland geol. surv., Cambrian and Ordovician, 1919, p. 266, pl. 49, figs. 11-13). Specimens of that species from Strasburg, Virginia, which are now before the writer allow direct comparison. Individuals of *O. holstonensis* are much smaller, more globose, and have on the average fewer plications in the fold and sinus than *O. simulatrix*. Specimens of the latter species 15 mm. in length are not uncommon.

Butts has recently figured (Geol. sur. Ala., Special Report 14, 1926, p. 126, pl. 31, fig. 21) a new species of *Oxoplecchia* from the lower part of the Chicamauga limestone of Alabama. The pedicle valve has almost exactly the same outline as *O. holstonensis*, but differs in that the sinus extends to the beak, whereas in our specimens the umbo is convex. The brachial valve assigned to *O. occidentalis* (Butts) appears to be less nearly circular in outline.

Horizon and Locality: — Ottosee by roadside, Fugates Hill, north of Mendota, Va.; and in the Holston, near Goodwins Ferry, New River, Va., Ross and Republic Quarry, 3 miles southeast of Knoxville, and at Concord, Tenn.; at the top of the Holston at the Thomas Farm, 3 miles east of Blacksburg, and at the McNutt Quarry, Sharon Springs, Va. Also in the Tellico at South Knoxville, Tenn. Holotype no. 8632, M. C. Z.

Superfamily PENTAMERACEA Schuchert.

Family CLITAMBONITIDAE Winchell and Schuchert.

Genus CLITAMBONITES Pander.

CLITAMBONITES PORCIA (Billings).

Orthis porcia Billings, Canadian nat. geol., 1859, 4, p. 439, figs. 16-18; Geol. Canada, 1863, p. 130, figs. 58a-c.

Clitambonites porcia Raymond, Ann. Carnegie mus., 1911, 7, p. 248, pl. 36, figs. 15-16.

The species is represented by parts of a few badly preserved pedicle valves. The better of these shows the shell to have a high pedicle valve of pyramidal outline. The interiors are not known from these specimens. The outer surface is marked by strong, though not very large, striations. It is distinguished from others of the genus largely through its coarser striations which make it easily confused with certain of the *Orthidae*. The dimensions are: length 14 mm., width 20 mm., length-width index 70. The greatest width is about one-third of the distance back from the anterior margin along which, in a space of five millimeters, are found seven striae.

Horizon and Locality: — Ottosee, north of Luttrell, Tenn., and Chazyan, two miles north of Montreal, Canada. It is also found in the Holston, at the base of the reef on the Hoge Farm, Bland County, Va., being represented by two pedicle valves and fragments of others both pedicle and brachial. They seem to be slightly smaller than the Ottosee specimens.

CLITAMBONITES HOLSTONI (Hall and Clarke).

Orthis (?) *holstoni* (Safford Ms.), Hall and Clarke, Pal. N. Y., 7, pt. 1, 1892, pp. 218, 340, pl. 5A, figs. 35-37; 14th rep. state geol. N. Y., for 1894, 1897, p. 339, pl. 4, figs. 19-21. Wysogorski, Zeits. d. d. geol. gesell., 52, 1900, p. 227, footnote.

This form has been distinguished from the similar Richmond types, *C. americana* Hall and Clarke, and *C. diversa* Shaler, by its greater width. It was described as an *Orthis*, but is undoubtedly a *Clitambonites*. It also resembles certain specimens of *C. trentonensis* Raymond, as figured from the Trenton of eastern Canada. Although the material is fragmental, the specimens show a long hinge line and shell wider than long, though the exact measurements cannot be determined. The pedicle valve shows a characteristically high cardinal area, the shell itself approaching the conical, whereas the brachial valve is more or less flattened. The surface has faint growth lines and coarse, radiating striations. The interior of a pedicle valve shows a large, deeply concave spondylium supported by a short, thin septum, and in the brachial shell the muscle-scars are separated by a high, rounded septum which extends beyond the middle. The species is distinguished by its long hinge line and coarse striae.

Horizon and Locality: — Holston near Goodwins Ferry, New River, and near White Gap and Tilsons Gap, Bland County, Va., and in the Lenoir of the Catawba Valley, Va. Also occurs in the Ottosee near Knoxville, Tenn.

Family PORAMBONITIDAE Davidson.
 Subfamily PARASTROPHIINAE Schuchert.
 Genus CAMARELLA Billings.

CAMARELLA PANDERI Billings.

Camarella panderi Billings, Canadian nat. geol. 1859, 4, p. 302; Geol. Canada, 1863, p. 143, figs. 78a-b. Hall and Clarke, Pal. N. Y., 1895, 8, pt. 2, p. 220, pl. 62, figs. 19-23. Raymond, Ann. Carnegie mus., 1911, 7, pl. 36, figs. 31, 32.

The species is possibly represented by several minute and evidently embryonic individuals. The outline is elliptical, slightly pointed posteriorly from the extension of the pedicle beak over the short hinge line. It is a biconvex brachiopod, the pedicle valve slightly more gibbous than the brachial. Some individuals are a little more sharply curved at the anterior margin, and both valves may show suggestions of plications at the front. The dimensions are: length 2.5 mm., width 2 mm., length-width index 125. The greatest width is at the middle. The form is distinguished by its small size.

Horizon and Locality:—Holston at Ross and Republic Quarry, 3 miles southeast of Knoxville, Tenn.; middle of reef at Hoge Farm, Bland Co., Va., Black River at Pauquettes Rapids, Ottawa River, Canada; Curdsville of Kentucky.

CAMARELLA VOLBORTHII Billings.

Camarella volborthi Billings, Can. nat. and geol., 1859, 4, p. 301; Geol. Canada, 1863, p. 143, figs. 77a-c. Hall and Clarke, Pal. N. Y., 1895, 8, pt. 2, p. 220, pl. 62, figs. 11-18, pl. 84, fig. 42.

This well-known species is rather common in the Ottosee at Liberty Hill, Tenn. Specimens from that locality are of about the usual size, have two plications in the sinus and three on the sides, but usually show a somewhat more shallow sinus than individuals from Canada or Central Tennessee.

Genus PARASTROPHIA Hall and Clarke.

PARASTROPHIA ROTUNDIFORMIS, nom. nov.

Anastrophia (?) *hemiplicata* var. *rotunda* Winchell and Schuchert, Minn. geol. surv., 1893, 3, pt. 1, p. 383, pl. 30, figs. 32-35.

Parastrophia hemiplicata rotunda Bassler, U.S. nat. mus., Bull. 92, 1915, 2, p. 945.

Parastrophia hemiplicata Hall is well known to be distinctly and typically a species confined to the Trenton in New York, Pennsylvania, Wisconsin, Minnesota, New Jersey, Ontario, Manitoba and Baffin Land. *Parastrophia hemiplicata rotunda* Winchell and Schuchert is reported only from the Trenton, at Cannon Falls, Minnesota, and Decorah, Ia. The specimens from the Holston of Tennessee seem to be identical with the latter so that, since it occurs at this lower level, it has been deemed wise to treat it as a distinct species rather than a variety of *P. hemiplicata* Hall; especially so, since the simpler plication arrangement hints at its possibly having an ancestral relation to the Trenton species. It is a subglobose brachiopod. The pedicle valve has a broad, shallow sinus and two plications therein with two or three on the lateral slopes. The brachial valve has a low fold on which are three plications that become flattened and appear to bifurcate at their anterior ends.

The dimensions are: length 13.5 mm., width 14.5 mm., length-width index 93. The greatest width is two-thirds of the length from the beaks forward. It is distinguished from *P. hemiplicata* Hall by its higher convexity and the fewer plications.

Since Reed has shown (Trans. Roy. Soc. Edinburgh, 51, 1917, no. 4, p. 928) that *Atrypa rotunda* Sowerby is a *Parastrophia*, it becomes necessary to suggest a new name for the species described by Winchell and Schuchert.

Horizon and Locality: — Holston, McNutt Quarry, Sharon Springs, Va., top of Holston, Thomas Farm, 3 miles east of Blacksburg, Va., Trenton, Cannon Falls, Minn., Decorah, Ia.

Order TELOTREMATA Beecher.

Superfamily RHYNCHONELLACEA Schuchert.

Family RHYNCHONELLIDAE Schuchert.

Genus CAMAROTOECHIA Hall and Clarke.

CAMAROTOECHIA QUADRIPLICATA, sp. nov.

Plate 2, fig. 14.

The shell is of medium size and of the usual form for the genus. The fold is low and the sinus shallow, so that neither makes a striking interruption in the curvature of the shell, and the outline is transversely oval, rather than triangular. The surface is crossed by angular, radial plications, four of which are in the sinus, five on the fold and six or

seven on each of the sides. Except at the front, there are no conspicuous growth lines, but the surface, when preserved, is covered with minute granules. One individual is 13.5 mm. long and 17 mm. wide. Nearly all of the others are a little smaller. The index is about 80.

This shell is referred to *Camarotoecchia* instead of *Rhynchotrema*, in the absence of any information as to the presence or lack of a cardinal process, and because of the absence of numerous growth lines. It appears to be nearly related to *Camarotoecchia plena*, which often has five plications on the fold and four in the sinus, but lacks the variability of that species, and differs in being distinctly broader than long. It is readily distinguished from *Rhynchotrema increbescens* (Hall) and *R. minnesotensis* (Sardeson) by the lack of growth lines, and the presence of an extra plication on the fold and sinus.

Horizon and Locality: — Specimens are fairly common but poorly preserved at the base of the Ottosee at Luttrell, Tenn., and exceedingly abundant in the upper part of the Holston about two miles northeast of Fugates Hill, north of Mendota, Va. Holotype no. 8633, M. C. Z.

No. 6b. — *The Brachiopods of the Lenoir and Athens Formations of Tennessee and Virginia.*

BY PERCY E. RAYMOND.

Order ATREMATA Beecher.

LINGULA NYMPHA Billings.

Plate 1, fig. 1.

Lingula nympha Billings, Pal. foss. Canada, 1865, 1, p. 214, fig. 198. Ami, Ottawa naturalist, 1894, 8, p. 85.

Shell very large, parallel-sided, convex, the anterior and lateral slopes flattened. The pedicle valve extends only very slightly beyond the opposite one, so that the beak is scarcely more pointed. The exterior shows the usual concentric growth lines, and there are also along the median region, from back to front, radial striations which are accentuated on partially exfoliated individuals.

The figured brachial valve is 58 mm. long and 26 mm. wide, with an index of 223. This shell is somewhat broader than specimens from Newfoundland, whose index, according to Billings, is about 270.

Horizon and Locality: — This is a common fossil in the shaly limestone of the Athens in the cutting one mile south of Otes, Tenn. Nearly all the specimens, however, have been obtained from material brought from this cutting to make a fill on the railroad about 1.5 miles north of Bulls Gap, Tenn. Figured specimen no. 8585, M. C. Z. Billings's specimens were from division N, (Normanskill), at Table Head, Newfoundland.

Order PROTREMATA Beecher.

ORTHIS DISPARILIS Conrad.

Orthis disparilis Conrad, Proc. acad. nat. sci. Philadelphia, 1843, 1, p. 333. See Bull. 92, U. S. nat. mus., 1915, 2, p. 898, for further synonymy.

The presence of this species in the Athens is indicated by a pedicle valve 9 mm. long and about 9.5 mm. wide. It has 25 small rounded plications, and a high incurved cardinal area. Another individual, retaining both shells, has a brachial valve 8 mm. long and 10 mm. wide. These specimens have a higher index than usual for this species, but as both are small, it seems better to place them here than as a new species.

Horizon and Locality: — The first specimen mentioned is from the Athens one mile south of Otes, Tenn. The second, from the Lenoir, between Bulls Gap and Whitesburg, Tenn.

HEBERTELLA BURSA, sp. nov.

Plate 1, fig. 7.

Shell of medium size, both valves moderately convex, hinge shorter than the greatest width of the shell. Surface covered with striations which in general effect appear simple, but increase by bifurcation and implantation close to the beak, and more rarely, near the front. On account of the place of introduction of new members, the striations increase in size uniformly from the umbo to the front, where there are 5 in the space of 5 mm.

The holotype is 26 mm. long and 29 mm. wide at the middle. The width at the hinge is 22 mm. and the index 90.

This species somewhat resembles *H. melonica* Willard and *H. borealis* Billings, but is very much less convex than either of those species.

Horizon and Locality: — A single complete but somewhat crushed individual was found in material taken from the railroad cutting 1 mile south of Otes, Tenn. The horizon is Athens. The holotype is no. 8597, M. C. Z.

PLECTORTHIS EXFOLIATA Raymond.

Hebertella exfoliata Raymond, Am. jour. sci., 1905, **20**, p. 370.

Plectorthis exfoliata Raymond, Ann. Carnegie mus., 1911, **7**, p. 238, pl. 35, figs. 11, 12.

Specimens from the Lenoir seem to agree in all respects with those from the typical Chazy. Both valves are convex, the width at the hinge does not quite equal the greatest width, and all show about 40 simple, thin, sharp plications. An average specimen is 13 mm. long, 15 mm. wide, and 13 mm. wide at the hinge. An unusually large individual is 15 mm. long.

Horizon and Locality: — This is a very common species in the Lenoir at Lenoir City and at Bluff City, Tenn., and one specimen was found 4 miles east of Concord, Tenn.

VALCOUREA VENTRO-CARINATA (Butts).

Strophomena ventro-carinata Butts. Geol. surv. Ala. special rept., 14, 1926, p. 116, pl. 26, figs. 16, 17.

Shell small, known only from the pedicle valve which is almost flat, being slightly convex at the beak, flat or slightly concave at the front.

The greatest width is at the hinge, the cardinal angles being acute but not greatly extended. The surface is covered with slender, granulose, angular striae, which increase both by bifurcation and implantation, the longer striae being much the more elevated and conspicuous.

A pedicle valve is 10 mm. long and 16 mm. wide at the hinge. There are 14 striae in a space of 5 mm. at the front.

This species differs from *Valcourea strophomenoides* Raymond, *V. deflecta* (Conrad) and all other species of the genus in the flatness of the pedicle valve.

Horizon and Locality: — The types of the species were collected from the Little Oak limestone at Pelham, Ala. Two specimens were found by the writer at the top of the Lenoir 1.5 miles east of Bluff City, Tenn.

VALCOUREA STROPHOMENOIDES Raymond.

Plaesiomys strophomenoides Raymond, Am. jour. sci., 1905, **20**, p. 370.

Valcourea strophomenoides Raymond, Ann. Carnegie mus., 1911, **7**, p. 240, pl. 35, figs. 15-19, pl. 36, fig. 1, text fig. 12.

Horizon and Locality: — A rare species in the Lenoir near the Ross and Republic quarry, southeast of Knoxville, Tenn.

PLAESIOMYS PLATYS (Billings).

Orthis platys Billings, Canadian nat. and geol., 1859, **4**, p. 438, figs. 15a-c. See Bull. 92, U. S. nat. mus., 1915, **1**, p. 444, for further references.

Horizon and Locality: — This species is fairly common in the Athens in the cutting one mile south of Otes, Tenn.

RAFINESQUINA CHAMPLAINENSIS Raymond.

Rafinesquina champlainensis Raymond, Bull. Am. Palaeontology, 1902, **3**, no. 14, p. 303, pl. 18, figs. 5, 6. Am. Carnegie mus., 1911, **7**, p. 233, figs. 6-9.

Specimens of this species from the Lenoir show the typical convexity and often the full size of species as it occurs in the typical Chazy. A pedicle valve is 41 mm. long and 40 mm. wide at the hinge, which is not quite the greatest width.

Horizon and Locality: — A common fossil in the Lenoir six miles

southeast of Knoxville, east of Concord, and between Bulls Gap and Whitesburg, Tenn.

RAFINESQUINA MINNESOTENSIS (Winchell).

Strophomena minnesotensis Winchell, 9th ann. rept. nat. hist survey of Minnesota, 1881, p. 120. See Bassler, Bull. 92, U. S. nat. mus., 1915, 2, p. 1088, for further references to the literature.

Horizon and Locality: — A single complete individual, of typical size and convexity, was found in the Lenoir 6 miles southeast of Knoxville, Tenn. It was 19 mm. long and 24 mm. wide at the hinge. A smaller specimen was obtained from the Lenoir at Lenoir City, Tenn.

RAFINESQUINA ALTERNATA (Emmons).

Strophomena alternata Emmons, Geology of New York, rept. 2nd district, 1842, p. 395, fig. 3. See Bull. 92, U. S. nat. mus., 1915, p. 1084, for further references to literature.

Small specimens, which have the low curvature, proportions and striae of this species were collected from the Lenoir four miles east of Concord, Tenn., six miles southeast of Knoxville, and east of Bluff City, Tenn.

RAFINESQUINA PULCHELLA, sp. nov.

Plate 2, fig. 10.

Shell very small, nearly as long as wide, widest at the hinge, but slightly constricted in front of it, so as to appear somewhat auriculate. Pedicle valve gently convex, highest at the beak, the umbonal region crossed by a narrow fold which gradually dies out at about the mid-length. The surface is covered by very delicate equal striae which increase by implantation. There are about 9 in a space of 2 mm. at the front.

One individual is 7.5 mm. long and 8.0 mm. wide at the hinge. The index varies on the specimens measured from 80 to 94.

This species may possibly be founded on the young of some larger form, but the occurrence of a considerable number of specimens all of the same size suggests that it is really a dwarf. It differs from the young of *Rafinesquina alternata* in having all the striae of the same size, and is much less convex than small specimens of *R. minnesotensis*.

Horizon and Locality: — A rather common fossil in the Lenoir near the L. and N. station at Athens, Tenn. Holotype no. 8624, paratype no. 8625, M. C. Z.

PLECTAMBONITES AMPLUS, sp. nov.

Plate 2, fig. 9; Plate 3, fig. 12.

Shell very large, deeply concavo-convex, with produced cardinal angles. The surface is crossed by alternating radial striae, each pair of the prominent ones having only three or four fainter ones between them. The median striation on the brachial valve is notably larger than the others.

The best specimen is about 18 mm. long and 35 mm. wide, the index being about 50.

This species is of about the same size and convexity as *Plectambonites crassus* Willard, from which it differs chiefly in that the prominent striae are not double.

Horizon and Locality: — A rare species in the Lenoir, six miles south-east of Knoxville, Tenn. The holotype is no. 8617, M. C. Z.

PLECTAMBONITES DELICATULUS Butts.

Plate 3, fig. 11.

Plectambonites delicatula Butts, Geol. surv. Ala., special rept., 14, 1926, p. 116, pl. 26, figs. 20, 21.

Shell of medium size, deeply concavo-convex, cardinal extremities acutely auriculate. A section along the median line would show the pedicle valve to be nearly semi-circular in profile. The surface is marked by rather distant prominent striae, which increase by implanation, and between each pair there are 6 or 7 low and faint striae, in the furrows between which are lines of small elongate depressions.

The brachial valve has a shallow median sinus on the umbonal region.

The plesiotype is 10 mm. long and 17 mm. wide at the hinge. There are 7 or 8 prominent striae in the space of 5 mm. at the front. The index is about 60.

This species differs from most of the other Ordovician *Plectambonites* of its size in its greater convexity. It is most closely allied to *P. pisum* Ruedemann (N. Y. State mus. bull., 49, 1901, p. 19, pl. 1, figs. 8-20) but differs in being larger and proportionally shorter, that species having an index of 80.

Horizon and Locality: — A rather rare fossil in the Lenoir 6 miles southeast of Knoxville, Tenn. Plesiotype no. 8612, M. C. Z. The original specimens were from the Little Oak limestone near Pelham, Ala.

CHRISTIANIA LAMELLOSA Butts.

Plate 3, figs. 18, 19.

Christiania lamellosa Butts, Geol. surv. Ala., special rept. 14, 1926, p. 116, pl. 26, figs. 31-34.

Shell small, subhemispherical, wider than long, the greatest width near the front being considerably more than that at the hinge. The pedicle valve is unsymmetrical in profile, the highest point behind the middle, and the umbo almost vertical. The brachial valve is more evenly concave. Surface covered with somewhat irregularly arranged concentric lines, but apparently without radial ornamentation.

One specimen is 8.5 mm. long, 13 mm. in greatest width, and 8 mm. wide at the hinge. The index is therefore about 66.

This species is most closely allied to *Christiania subquadrata* Hall, which is now believed to have been obtained from the Ottosee of Blount Co., Tenn. (See Bassler, Bull. 92, U. S. Nat. Mus., 1915, 1, p. 221). It agrees with that form in the presence of concentric and absence of radial striae, but differs in being wider than long. *Christiania trentouensis* Ruedemann is not only proportionately longer than *C. lamellosa*, but also has radial striae.

Horizon and Locality: — A rare fossil in the Lenoir near the L. & N. station at Athens, Tenn., and 6 miles southeast of Knoxville, Tenn. Plesiotype is no. 8618 in the M. C. Z.

OXOPLECIA HOLSTONENSIS Willard.

Horizon and Locality: — A single brachial valve was collected in material brought from the cutting through the Athens one mile south of Otes, Tenn.

It is 10 mm. long, 13.5 mm. broad, has 5 plications on the fold, and 10 on either side. All are crossed by closely spaced concentric lamellae of growth.

CAMARELLA LONGIROSTRA Billings.

Camerella longirostra Billings, Can. nat. and geol., 1859, 4, p. 302, 445, fig. 23.

See Bull. 92, U. S. nat. mus., 1915, 1, p. 172, for further references.

Specimens which can be referred to this species are very common in the Lenoir at Bluff City, Tenn. The pedicle valve is proportionately wider than that of individuals from the typical Chazy, but this does not seem a justifiable basis for erection of a new species.

A large brachial valve is 7.5 mm. long and 8.25 mm. wide. A pedicle

valve is 7 mm. long and 6 mm. wide, the index being 116 as compared with an index of 133 to 140 for shells from Valcour Island, N. Y., and an index of 131 to 150 for specimens from the Mingan Islands measured or figured by Billings. There is in fact a wide difference in proportions between Billings' figured type and the specimens found in Tennessee.

CAMARELLA PANDERI Billings.

Camarella panderi Billings, Can. nat. and geol., 1859, **4**, p. 302; Geol. of Canada, 1863, p. 143, figs. 78a, b. Hall and Clarke, Pal. N. Y., 1895, **8**, pt. 2, p. 220, pl. 62, figs. 19-23. Raymond, Ann. Carnegie mus., 1911, **7**, pl. 36, figs. 31, 32.

Horizon and Locality: — A specimen 3.5 mm. long and 3 mm. wide was collected from the Lenoir at Lenoir City, Tenn.

CAMARELLA VARIANS Billings.

Camarella varians Billings, Can. nat. and geol., 1859, **4**, p. 445, fig. 24; Geol. Canada, 1863, p. 127, figs. 52a-d; Pal. foss. Canada, 1865, **1**, p. 220. Raymond, Ann. Carnegie mus., 1911, **7**, p. 250, pl. 36, figs. 19-27, 33-36.

This variable shell was obtained from the Lenoir east of Bluff City, Tenn. One pedicle valve, 9 mm. long, has two plications in the sinus. Another, 8 mm. in length, has only one, and that a short and inconspicuous ridge.

Order TELOTREMATA Becher.

CAMAROTOECHIA PRISTINA Raymond.

Camarotoechia pristina Raymond, Am. Jour. Sci., 1905, ser. 4, 20, p. 368; Ann. Carnegie mus., 1911, **7**, p. 225, pl. 34, figs. 1-10.

This species is recognized by the fact that the median pair of plications on the fold of the dorsal valve are introduced later in life than the outer pair, and hence are usually smaller.

Horizon and Locality: — A single brachial valve, 6 mm. long and 8 mm. broad, was found in the Lenoir at Lenoir City, Tenn. The species is found in the upper part of the Lower Chazy and the lower part of the Upper Chazy in New York.

ZYGOSPIRA ACUTIROSTRA (Hall).

Atrypa acutirostra Hall, Pal. N. Y., 1847, **1**, p. 21, pl. 4, bis., fig. 6. See Bull. 92, U. S. nat. mus., 1915, **2**, p. 1340, for further references.

Numerous specimens of this small shell were found in the Lenoir one mile east of Bluff City, Tenn. A characteristic individual from that

locality is 3 mm. long, 2.5 mm. in width and has 10 plications. The specimens differ from those found in the typical Chazy chiefly in that the median plication on the pedicle valve is not conspicuously larger than the others.

THE RELATIONSHIPS OF THE BRACHIOPODS OF THE LENOIR, HOLSTON, ATHENS, AND OTTOSEE FORMATIONS.

THE LENOIR.

Twenty-one species of brachiopods have been reported above from the Lenoir, the oldest of the formations under discussion. The fossils have been derived from three somewhat widely separated localities, under the names of which they will be listed.

VICINITY OF KNOXVILLE.

Under this heading are included the species collected southeast of Knoxville, east of Concord, and at Lenoir City, Tenn. This is the typical region for the Lenoir.

Plectorthis exfoliata Raymond, *Valcourea strophomenoides* Raymond, *Rafinesquina champlainensis* Raymond, *R. minnesotensis* (Winchell), *R. alternata* (Emmons), *Plectambonites amplius* Raymond, *P. delicatulus* Butts, *Camarella panderi* Billings, and *Camarotoecchia pristina* Raymond.

BLUFF CITY, TENN.

This locality is about one hundred miles northeast of Knoxville, not far from Bristol.

Plectorthis exfoliata Raymond, *Valcourea ventro-carinata* (Butts), *Rafinesquina alternata* (Emmons), *Camarella longirostra* Billings, *C. varians* Billings, and *Zygospira acutirostra* (Hall).

CATAWBA VALLEY, NORTH OF SALEM, VA.

This locality is about 330 miles northeast of Knoxville.

Hebertella vulgaris Raymond, *Plaesiomys platys* (Billings), *Dinorthis pectinella* (Emmons), *Plectambonites negritus* Willard, and *Clitambonites holstoni* (Hall and Clarke).

Three species, not found at any of the above localities, are:

Orthis disparilis Conrad, *Rafinesquina pulchella* Raymond, and *Christiania lamellosa* Butts. The last two have not been found associated with other species typical of the Lenoir.

COMPARISON OF THE LENOIR WITH THE CHAZY.

It will be at once noted that the brachiopods of the Lenoir have a strongly Chazyan aspect. *Plectorthis exfoliata*, *Hebertella vulgaris*, *Plaesiomys platys*, *Valcoura strophomenoides*, *Rafinesquina champlainensis*, *Camarella longirostra*, *C. varians*, *Camarotoecchia pristina* and *Zygospira acutirostra*, 9 of the 21 species, were originally described from the Chazy. *Orthis disparilis*, *Valcoura ventro-carinata*, and *Clitambonites holstoni* have near allies in the Chazy, and *Rafinesquina alternata* occurs in that formation.

These species have such long vertical ranges in the typical Chazy, however, that they do not afford evidence for exact correlation. The presence of *Rafinesquina champlainensis*, *Plaesiomys platys*, and *Camarella varians* would in the typical region of the Chazy, generally indicate Middle Chazy, and the impression of the writer at the present time is that the Lenoir is neither youngest nor oldest Chazy. The only element of the fauna which is not Chazyan is seen in the presence of *Plectambonites* and *Christiania*. Neither of these genera has been found in the Chazy, and their absence has been a striking characteristic of that fauna. Their presence in the Southern Appalachians indicates that we have here a mixture of two faunal elements, but both European in origin.

THE HOLSTON.

The Holston has a rather surprisingly large fauna of brachiopods, many of which, however, are at present known only from a single small quarry at Sharon Springs, Bland Co., Va. The fauna will be listed under three headings.

VICINITY OF KNOXVILLE, TENN.

This includes Fountain City, South Knoxville, and Concord.

Palaeoglossa belli (Billings), *Placsiomys platys* (Billings), *Pionodema minuseula* Willard, *Plectambonites uegritus* Willard, *Leptaena palustris* Willard, *Rafinesquina duplicistriata* Willard, *Ptychoglyptus virginicensis* Willard, and *Camarella panderi* Billings.

BLAND COUNTY, VA.

This includes the Hoge farm, near Bland, as well as the McNutt quarry at Sharon Springs, and is about 185 miles northeast of Knoxville.

Lingula lyelli Billings, *Schizambon cuneatus* Willard, *Conotreta declivis* Willard, *Acrosaccus shuleri* Willard, *A. pannus* Willard, *Petrocrania prona* Raymond, *Hebertella melonica* Willard, *H. vulgaris* Raymond, *Dinorthis pectinella* (Emmons), *Nicolella agileria* Willard, *Plectambonites crassus* Willard, *Rafinesquina minnesotensis* (Winchell), *R. champlainensis* Raymond, *R. distans* Raymond, *R. grandistriata* Willard, *Ptychoglyptus virginicensis* Willard, *Oxopleeia holstonensis* Willard, *Clitambonites porcia* (Billings), *Camarella panderi* Billings, and *Parastrophia rotundiformis* Willard.

VARIOUS LOCALITIES.

The following species have been found at various localities in southwestern Virginia, from Blacksburg on the east to Speers Ferry on the west.

Lingula narrawayi Wilson, *Plectorthis holdeni* Willard, *Dinorthis atavoides* Willard, *Plectambonites equistriatus* Willard, *P. pisum* Ruedemann, *P. triseptatus* Willard, *Leptaena prona* Willard, *Strophomena tenuitesta* Willard, *Clitambonites holstoni* (Hall and Clarke), and *Camarotoecchia quadriplicata* Willard.

COMPARISON OF THE BRACHIOPODS OF THE HOLSTON WITH THOSE OF THE CHAZY.

The Holston contains some Chazy species, although they do not dominate the fauna, as in the case of the Lenoir. They are: *Palaeoglossa belli* (Billings), *Lingula lyelli* Billings, *Petrocrania prona* Raymond, *Hebertella vulgaris* Raymond, *Placsiomys platys* (Billings),

Rafinesquina champlainensis Raymond, *R. distans* Raymond, and *Clitambonites porcia* (Billings). Two more species, *Schizambon cuneatus* Willard and *Clitambonites holstoni* are very similar to Chazyan brachiopods. The Chazyan element in the Holston amounts to about 25% as contrasted with about 50% in the case of the Lenoir. The element unknown to the Chazy is large and contains *Conotreta*, *Acrosaccus*, *Nicolella*, *Pionodema*, *Plectambonites*, *Ptychoglyptus*, *Oxoplectia* and *Parastrophia*. *Acrosaccus*, *Nicolella* and *Ptychoglyptus* are unknown elsewhere in America, but *Conotreta*, *Oxoplectia* and *Parastrophia* are known from post-Chazyan formations.

THE OTTOSEE.

The greater part of the brachiopods collected from the Ottosee were obtained at two localities, neither of which is in the typical region about Knoxville, Tenn. It is known that this formation is very prolific in brachiopods at other localities which I have not visited, and the species described by Dr. Willard probably represent only a small part of the fauna.

LUTTRELL, TENN. ABOUT 20 MILES NORTH OF KNOXVILLE.

Schizambon cuneatus Willard, *Petrocrania prona* Raymond, *P. cicatricula* Willard, *Orthis disparilis* Conrad, *Plectorthis exfoliata* Raymond, *Hebertella melonica* Willard, *H. vulgaris* Raymond, *Glyptorthis bellarugosa* (Conrad), *Plaesiomys platys* (Billings), *Dinorthis pectinella* (Emmons), *D. quadriplicata* Willard, *D. transversa* Willard, *Pionodema globosa* Willard, *Plectambonites curdsvillenses* Foerste, *Rafinesquina minnesotensis* (Winchell), *R. duplicistriata* Willard, *Clitambonites porcia* (Billings), and *Camarotoechia quadriplicata* Willard.

FUGATES HILL, 7 MILES NORTH OF MENDOTA, VA., AND 85 MILES NORTHEAST OF LUTTRELL.

Orthis disparilis Conrad, *Plectorthis exfoliata* Raymond, *Hebertella melonica* Willard, *Plaesiomys platys* (Billings), *P. brevis* Willard, *Dinorthis interstriata* Willard, *D. quadriplicata* Willard, *D. transversa* Willard, *Pionodema subaequata* (Conrad), *P. globosa* Willard, *Plectambonites curdsvillensis* Foerste, *P. aequistriatus* Willard, *Rafinesquina minnesotensis* (Winchell), *R. champlainensis* Raymond, *R. duplicistriata* Willard, *Strophomena filitexta* (Hall), *S. tennesseensis* Willard, *S. inspeciosa* Willard, and *Oxoplectia holstonensis* Willard.

LIBERTY HILL, TENN.

This locality is only 15 miles north of Luttrell, but it is the most western (geologically not geographically) outcrop of the Ottosee at which the fauna can be definitely recognized.

Glyptorthis bellarugosa (Conrad), *Dalmanella rogata* (Sardeson), *Plaesiomys platys* (Billings), *P. elongata* Willard, *Pionodema globosa* Willard, *Plectambonites aequistriatus* Willard, *Rafinesquina minnesotensis* (Winchell), *Strophomena filitexta* (Hall), *S. tennesseensis* Willard, *S. inspeciosa* Willard, and *Camarella volborthi* Billings.

VARIOUS LOCALITIES.

In addition to the species listed above, Bassler finds that the type of *Christiania subquadrata* Hall was obtained from the Ottosee of Blount Co., Tenn., and I found a single valve of *Christiania* at the same horizon on the Hoge Farm, Bland Co., Va.

CHAZYAN ELEMENT IN THE OTTOSEE.

Petrocrania prona Raymond, *Plectorthis exfoliata* Raymond, *Hebertella vulgaris* Raymond, *Plaesiomys platys* (Billings), *Rafinesquina champplainensis* Raymond, and *Clitambonites porcia* (Billings) are species described originally from the Chazy, *Glyptorthis bellarugosa* (Conrad) is found in the Chazy on Valcour Island, N. Y., *Camarotoechia quadriplicata* is hardly distinguishable from one of variants of *C. plena* (Hall), and *Schizambon cuneatus* Willard is very like *S. duplicimuratus* Hudson. Thus nine of the thirty-one species, or 29% are distinctly Chazyan. The non-Chazyan element is represented by *Dalmanella*, *Dinorthis*, *Pionodema*, *Plectambonites*, *Christiania*, and *Oxoplecia*.

THE ATHENS.

Brachiopods are very seldom found in the Athens, and the five species so far found are all from one locality south of Otes, Tenn. One only, *Lingula nympha* Billings, is of any particular interest. This large and striking *Lingula* has previously been known only from the Normanskill of Newfoundland. *Hebertella bursa* Raymond is the only unique species, *Plaesiomys platys* (Billings) occurs in the Chazy, *Orthis disparilis* (Conrad) is similar to the Chazyan *O. ignicula* Raymond, and *Oxoplesia holstonensis* survived from the Holston and Ottosee.

THE VERTICAL RANGE OF THE SPECIES.

The faunas of the Lenoir, Holston, Ottosee and Athens are rather strongly individualized, but there are some species which seem to connect them. Only one, *Plaesiomys platys*, is found in all four, but *Rafinesquina minnesotensis*, *R. champlainensis*, *Hebertella vulgaris* and *Dinorthis pectinella* are found in all but the Athens. *Clitambonites holstoni* is found in both the Lenoir and the Holston, *Plectorthis exfoliata* connects the Lenoir and Ottosee, and *Orthis disparilis* is in the Lenoir, Ottosee, and Athens. Altogether, 8 of the 21 species of the Lenoir pass on into one or more younger formations.

Thirty-six species are recorded by Willard from the Holston; 6 of these are survivors from the Lenoir, and 12 continue into the Ottosee. The Holston and Ottosee faunas are therefore closely allied.

Willard found 31 species in the Ottosee, 7 of which survived from the Lenoir and 12 from the Holston. Still, there are 16 species, or more than half the fauna, not shared with the other formations in this region.

Two of the 5 brachiopods so far found in the Athens survived from the Lenoir, one is a familiar Chazyan type of *Hebertella*, and one is a *Lingula* which probably drifted in with the pelagic trilobites. The discovery of a *Ptychoglyptus* in the Athens of Alabama is of interest as suggesting a connection of the Athens and Holston.

THE BRACHIOPODS OF THE STONES RIVER IN
CENTRAL TENNESSEE.

The brachiopods of eastern Tennessee and Virginia should be compared with those of the Stones River group in central Tennessee. This group includes the following members, in descending order, viz: Lebanon limestone, Ridley limestone, Pierce limestone, and Murfreesboro limestone.

LEBANON LIMESTONE.

The following species, except for the two marked with an asterisk, whose names are taken from a list by Dr. Ulrich, were collected by the writer at Lebanon, Tennessee.

Petrocrania sp. ind., *Leptobolus* sp. ind., **Orthis tricnaria* Conrad, *Pionodema minuseula* Willard, *Plaesiomys deflecta* (Conrad), *Glyptorthis bellarugosa* (Conrad), *Rafinesquina minnesotensis* (Winchell), **Plectambonites* sp. ind., *Strophomena filitexta* (Hall), *Scenidium*

anthonense Sardeson, *Rhynchotrema minnesotense* (Sardeson), and *Zygospira saffordi* (Winchell and Schuchert).

RIDLEY.

The following species were collected by the writer on Stones River near Murfreesboro, Tennessee.

Orthis disparilis Conrad, *Glyptorthis bellarugosa* (Conrad), *Rafinesquina minnesotensis* (Winchell), *R. alternata* (Emmons), *Camarella volborthi* Billings, and *Protorhyncha ridleyana* (Safford).

PIERCE.

The following brachiopods are listed from the Pierce in Folio 95, U. S. G. S., 1903, by Ulrich.

Pionodema subaequata (Conrad), *P. stonensis* (Safford), *Strophomena filitexta* (Hall) and *Protorhyncha ridleyana* (Safford).

MURFREESBORO.

The following species were collected by the writer from cherts in the Murfreesboro near Stones River about a mile west of Murfreesboro, Tenn.

Rafinesquina cf. *distans* Raymond, *R. sp. ind.*, and *Zygospira saffordi* (Winchell and Schuchert).

COMPARISON OF EASTERN FAUNAS WITH THOSE OF THE STONES RIVER.

The Murfreesboro evidently contains very few brachiopods, in fact, no previous investigator has reported any. The small fauna is of no value in correlation, although one of the *Rafinesquinas* suggests *R. distans*, which occurs in the Holston, and *Zygospira saffordi* is not very different from the *Zygospira acutirostra* of the Lenoir.

The fauna of the Ridley may be rather definitely connected with the Ottosee. All of the species known from the Ridley except *Protorhyncha ridleyana* have been found in the Ottosee, but the most striking bond between the two formations is the presence of *Camarella volborthi* at Liberty Hill, and of *Glyptorthis bellarugosa* at Liberty Hill and Luttrell in the Ottosee. These species do not occur in the other eastern formations and are particularly abundant and characteristic in the Ridley. The occurrence of an *Oxoplectra* closely allied to *O. holstonensis* in the Ridley of Alabama is also significant.

The fauna of the Pierce is of interest chiefly as the first appearance of *Pionodema subaequata* and *Strophomena filitexta* in central Tennessee. These species appear first in the Ottosee in eastern Tennessee.

The fauna of the Lebanon is also more closely allied to that of the Ottosee than to any of the other eastern formations. From other evidence, however, it appears that it is really somewhat younger than the Ottosee and the likeness was acquired through descent. Particular interest attaches to the fact that *Plectambonites* appears in this section first in the Lebanon, and is not common there. In fact the entire Stones River series of brachiopods appears to have been derived from the eastern basin, with the possible exception of *Protorhyncha*, but it in its turn made no contribution to the eastern fauna.

THE BRACHIOPODS OF THE GIRVAN DISTRICT, SCOTLAND.

The Llandeilo is represented in the Girvan district, Ayrshire, by the Stinchar and Balclatchie formations, the former being the older. According to Reed, who has monographed the faunas (Trans. Royal Soc. of Edinburgh, 51, 1917, pt. 4, pp. 795-998, pl. 1-24), sixty named species and varieties of brachiopods are known from the Stinchar limestone, twenty of which pass into the Balclatchie, and there are seventy species in the latter. Reed commented on the fact that these faunas were more nearly like those of the American Middle Ordovician than like those of the Llandeilo of other parts of Great Britain, but did not make comparisons with particular faunas.

Although there are no species common to Virginia, Tennessee, and Scotland, nearly all the genera occur in both regions, and at least two, *Nicolella* and *Ptychoglyptus* are, so far as is known at present, restricted to the Girvan District and the southern Appalachians. Other significant genera, not of wide distribution either in Europe or North America, are: *Conotreta*, *Schizambon*, *Christiania*, *Camarella* and *Oxoplecia*. *Dalmanella*, *Christiania*, *Plectambonites*, *Camarella*, *Parastrophia*, and *Oxoplecia*, with perhaps other genera, were probably introduced from Europe in Chazy times, very likely *via* Newfoundland.

The following table will show, in parallel columns, which of the American species have close allies in the Girvan district. L, H, O, or A after a species in the American list signifies that it is found in the Lenoir, Holston, Ottosee or Athens. In the Scottish list, S signifies Stinchar and B the Balclatchie.

Virginia — Tennessee.

Girvan District.

<i>Palaeoglossa belli</i> . H.	<i>Palaeoglossa amabilis</i> . B.
<i>Lingula lyelli</i> . H.	<i>Lingula angustior</i> . B.
<i>L. nympha</i> . A.	<i>Lingulasma? ardmillanensis</i> . B.
<i>Schizambon cuneatus</i> . H. O.	<i>Schizambon scoticus</i> . S.
<i>Conotreta declivis</i> . H.	<i>Conotreta conoidea</i> . S. B.
<i>Petrocrania prona</i> . H. O.	<i>Philhedra playfairi</i> . B.
<i>Orthis disparilis</i> . L. O. A.	<i>Orthis craigensis</i> . S.
<i>Plectorthis exfoliata</i> . L. O.	<i>Plectorthis duftonensis</i> . B.
<i>P. holdeni</i> . H.	<i>P. subplicatella</i> . B.
<i>Hebertella vulgaris</i> . L. H. O.	<i>Hebertella scotica</i> . S. B.
<i>H. melonica</i> . H. O.	<i>H. bellatrix</i> . B.
<i>H. bursa</i> . A.	<i>H. rankini</i> . B.
<i>Glyptorthis bellarugosa</i> . O.	<i>Glyptorthis balclatchiensis</i> . S. B.
<i>Dalmanella rogata</i> . O.	<i>Dalmanella gracilis</i> . S. B.
<i>Pionodema globosa</i> . O.	<i>Pionodema girranensis</i> . S. B.
<i>Dinorthis transversa</i> . O.	<i>Dinorthis carrickensis</i> . S. B.
<i>Nicolella agileria</i> . H.	<i>Nicolella actoniae</i> . S. B.
<i>Rafinesquina minnesotensis</i> . H. O.	<i>Rafinesquina semiglobosina</i> . S. B.
<i>R. alternata</i> . L.	<i>R. concentrica</i> . B.
<i>Plectambonites delicatulus</i> . L.	<i>Plectambonites llandeiloensis</i> . B.
<i>P. crassus</i> . H.	<i>P. conspicua</i> . B.
<i>Ptychoglyptus virginienensis</i> . H.	<i>Ptychoglyptus subarachnoidea</i> . B.
<i>Christiania umbonata</i> . L. O?	<i>Christiania youngiana</i> . S. B.
<i>Strophomena filitexta</i> . O.	<i>Strophomena deficiens</i> . S. B.
<i>Oxoplectia holstonensis</i> . H. O. A.	<i>Oxoplectia andersoni</i> . S. B.
<i>Camarella longirostra</i> . L.	<i>Camarella balclatchiensis</i> . S. B.
<i>C. varians</i> . L.	<i>C. thompsoni</i> . S.
<i>C. volborthi</i> . O.	<i>C. pcachi</i> . S.
<i>Parastrophia rotundiformis</i> . H.	<i>Parastrophia youngi</i> . S. B.
<i>Camarotoechia quadriplicata</i> . H. O.	<i>Rhynchotrema lapworthi</i> . S.

Summarizing the above, 7 of the 21 species in the Lenoir are closely allied to species in the Girvan district, 15 of the 36 species in the Holston, 17 of the 31 in the Ottosee, more than half, and 4 of the 5 in the Athens. A curious feature of the resemblances is, that the allied species for each of the American formations are about equally distributed between the Stinchar and the Balclatchie, and it is not possible to correlate the formations except in a general way.

Thus, 3 of the species allied to Lenoir forms are found in both the Stinchar and Balclatchie, and 6 are in the Balclatchie as against 5 in the Stinchar. Five of the species allied to brachiopods of the Holston are found in both Stinchar and Balclatchie, 12 are found in the Balclatchie, and 8 in the Stinchar. This suggests that the Holston is more nearly akin to the Balclatchie, but when the Ottosee brachiopods are compared, we find 12 allied species in the Balclatchie as against 13 in the Stinchar, and yet the Ottosee rests on the Holston. Nine of the allied species are in this case common to the Stinchar and Balclatchie. The Athens contains too few brachiopods to make comparisons of any value, but as I have shown in a previous paper, (Bull. Mus. Comp. Zool., 67, 1925, pp. 1-180) the trilobites of that formation are very much like those of the Balclatchie.

EXPLANATION OF PLATES.

PLATE 1.

PLATE 1.

Fig. 1. *Lingula nympha* Billings. A complete specimen from the Athens south of Otes, Tenn. $\times$ about $\frac{3}{5}$.

Fig. 2. *Lingula lyelli* Billings. A pedicle valve from the Holston at Sharon Springs, Va. $\times$ $\frac{1}{7}$.

Fig. 3. *Palaeoglossa gibbosa* Willard. A pedicle valve from the Murat at Lexington, Va. $\times$ $\frac{1}{5}$.

Fig. 4. *Schizambon cuneatus* Willard. A pedicle valve from Sharon Springs, Va. $\times$ 2.

Fig. 5. *Plectorthis holdeni* Willard. A pedicle valve from the base of the Holston at Speers Ferry, Va. $\times$ $1\frac{1}{2}$.

Fig. 6. *Petrocrania prona* Raymond. Interior of a brachial valve from the base of the Ottosee at Luttrell, Va. $\times$ $\frac{7}{8}$.

Fig. 7. *Hebertella bursa* Raymond. Brachial valve of a specimen from the Athens south of Otes, Tenn. $\times$.96.

Fig. 8, 9. *Hebertella melonica* Willard. Brachial and pedicle valves of the holotype from the Ottosee at Fugates Hill, north of Mendota, Va. $\times$ $1\frac{1}{4}$.

Fig. 10. *Plaesiomys platys* (Billings). Interior of a brachial valve from the Ottosee at Liberty Hill, Tenn. $\times$ 1.1.

Fig. 11. The same species. Pedicle valve of a specimen from the Ottosee at Speers Ferry, Va. $\times$ $\frac{4}{5}$.

Fig. 12. *Plaesiomys brevis* Willard. Pedicle valve of a small specimen from the Ottosee at Fugates Hill, north of Mendota, Va. $\times$ $1\frac{1}{2}$.

Fig. 13. *Dinorthis quadriplicata* Willard. Pedicle valve of the holotype from the Ottosee, at Fugates Hill, north of Mendota, Va. $\times$ 1. (See also figs. 5, 6, pl. 3).

Fig. 14. *Plaesiomys brevis* Willard. Brachial valve of a larger individual from the same horizon and locality as number 12. $\times$ $1\frac{1}{3}$.

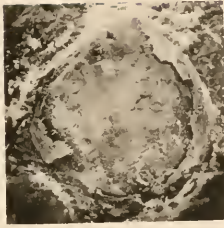
Fig. 15, 16. *Plaesiomys elongata* Willard. Brachial and pedicle valves of the holotype from the Ottosee at Liberty Hill, Tenn. $\times$ 1.1.



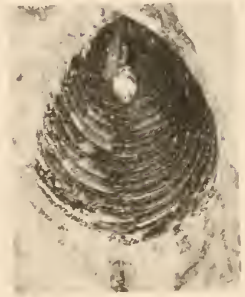
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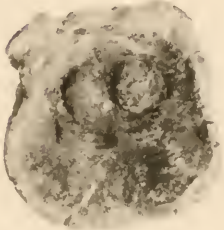
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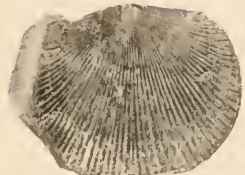
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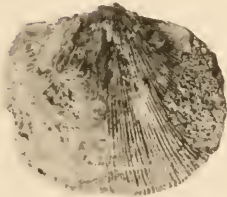
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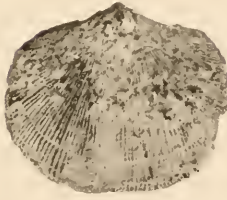
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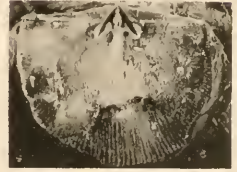
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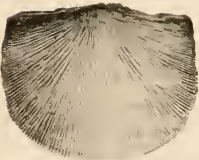
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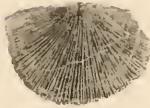
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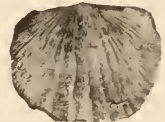
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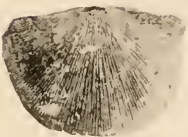
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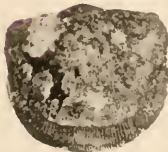
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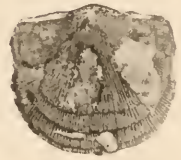
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PLATE 2.

PLATE 2.

Fig. 1. *Dinorthis transversa* Willard. Pedicle valve of the holotype from the Ottosee at Luttrell, Tenn. $\times \frac{4}{5}$.

Fig. 2. The same specimen. Brachial valve. $\times 1$.

Fig. 3. *Pionodema minuscula* Willard. Pedicle valve of the holotype from the Lebanon at Lebanon, Tenn. $\times 1\frac{4}{5}$.

Fig. 4. *Dinorthis atavoides* Willard. Pedicle valve of the holotype from the Holston west of Speers Ferry, Va. $\times 1\frac{1}{3}$.

Fig. 5. *Pionodema globosa* Willard. Pedicle valve of the holotype from the Ottosee at Fugates Hill, north of Mendota, Va. $\times 1$.

Fig. 6. *Dinorthis transversa* Willard. Pedicle valve of a paratype from the same horizon and locality as numbers 1 and 2. $\times 1$.

Fig. 7. *Plectambonites triseptatus* Willard. Interior of a pedicle valve, (paratype), from the Holston near Goodwins Ferry, Va. $\times 1.46$.

Fig. 8. The same species. Interior of a brachial valve (holotype) from the same horizon and locality as the last. $\times 1$.

Fig. 9. *Plectambonites amplius* Raymond. Brachial valve of the holotype, from the Lenoir 6 miles southeast of Knoxville, Tenn. $\times 1$. See also fig. 12, pl. 3.

Fig. 10. *Rafinesquina pulchella* Raymond. Pedicle valve of the holotype from the Lenoir at Athens, Tenn. $\times 2$.

Fig. 11. *Rafinesquina grandistriata* Willard. Pedicle valve of the holotype from the Holston at Sharon Springs, Va. $\times 1\frac{6}{7}$.

Fig. 12. *Ptychoglyptus virginienensis* Willard. Pedicle valve of the holotype from the Holston at Sharon Springs, Va. $\times 1\frac{3}{4}$.

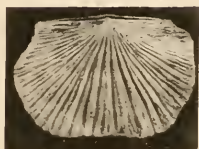
Fig. 13. *Strophomena inspeciosa* Willard. Holotype from the Ottosee at Liberty Hill, Tenn., showing brachial valve and cardinal area. $\times 1\frac{1}{4}$. —

Fig. 14. *Camarotoechia quadriplicata* Willard. Pedicle valve of the holotype from the base of the Ottosee at Luttrell, Tenn. $\times 1$.

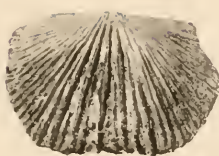
Fig. 15, 16. *Strophomena tenuilesta* Willard. Brachial and pedicle valves of the holotype, from the Holston west of Speers Ferry, Va. $\times 0.85$.

Fig. 17. *Strophomena tennesseensis* Willard. Pedicle valve of one of the cotypes from the Ottosee at Fugates Hill, north of Mendota, Va. $\times 1\frac{1}{2}$.

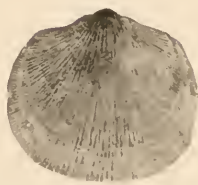
Fig. 18. The same species. Interior of pedicle valve of the other cotype from the same horizon and locality. $\times \frac{3}{4}$.



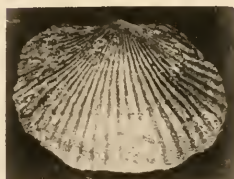
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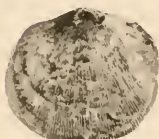
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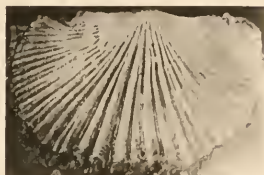
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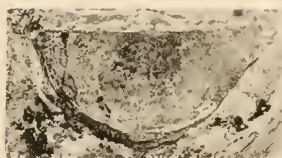
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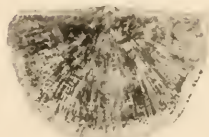
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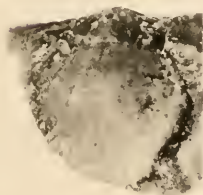
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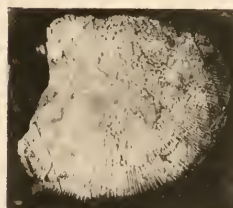
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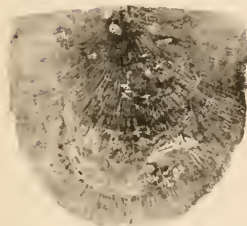
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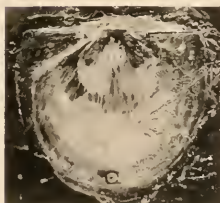
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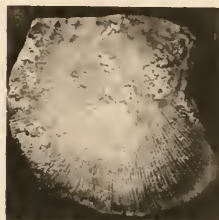
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PLATE 3.

PLATE 3.

Fig. 1. *Acrosaccus shuleri* Willard. One of the cotypes, a brachial valve, from the Holston at Sharon Springs, Va. $\times 3\frac{1}{3}$.

Fig. 2. The same species. Lateral view of the other cotype, a pedicle valve from the same horizon and locality. $\times 2$.

Fig. 3. *Acrosaccus pannus* Willard. The holotype, viewed from the interior of the pedicle valve, the posterior end at the top. Note trace of pedicle tube behind apex. From the Holston at Sharon Springs, Va. $\times 1\frac{1}{3}$.

Fig. 4. *Petrocrania cicatricula* Willard. Interior of the brachial valve of the holotype from the base of the Ottosee at Luttrell, Tenn. $\times 1\frac{1}{3}$.

Fig. 5, 6. *Dinorthis quadriplicata* Willard. Posterior and pedicle views of the holotype from the Ottosee at Fugates Hill, north of Mendota, Va. $\times 1$. (See also pl. 1, fig. 13.)

Fig. 7. *Nicolella agilera* Willard. Pedicle valve of the holotype from the Holston at Sharon Springs, Va. $\times 1$.

Fig. 8. *Plectambonites aequistriatus* Willard. Interior of pedicle valve of one of the cotypes from the Ottosee at Liberty Hill, Tenn. $\times 2$.

Fig. 9. The same species. The brachial valve and cardinal area of the pedicle valve of the other cotype from the same horizon and locality. $\times 2$.

Fig. 10. *Plectambonites crassus* Willard. Enlargement of a small piece of the surface of the holotype to show the double nature of the major striae. From the Holston at Sharon Springs, Va. $\times 6\frac{2}{3}$.

Fig. 11. *Plectambonites delicatulus* Butts. An individual from the Lenoir 6 miles southeast of Knoxville, Tenn. $\times 2$.

Fig. 12. *Plectambonites amplius* Raymond. An enlargement of part of the surface of the holotype to show striations. $\times 6\frac{2}{3}$. See also pl. 2, fig. 9.

Fig. 13. *Plectambonites negritus* Willard. Pedicle valve of the holotype. From the Lenoir in the Catawba Valley, north of Salem, Va. $\times 2\frac{2}{3}$.

Fig. 14. *Leptaena palustris* Willard. Pedicle valve (holotype) from the Holston at Concord, Tenn. $\times 2\frac{2}{3}$.

Fig. 15, 16. *Leptaena prona* Willard. Profile and drawing of the pedicle valve of the holotype, from the Holston at Goodwins Ferry, Va. $\times 1$.

Fig. 17. *Oxoplecia holstonensis* Willard. A pedicle valve (holotype) from the Holston at Sharon Springs, Va. $\times 2$.

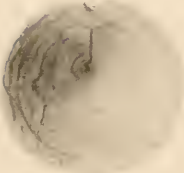
Fig. 18, 19. *Christiania lamellosa* Butts. A fragmentary specimen viewed from the dorsal side, and a mold of the brachial valve. From the Lenoir at Athens, Tenn. $\times 2$.



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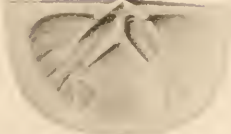
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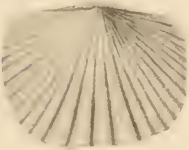
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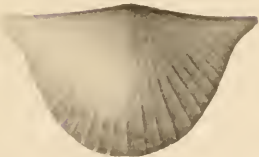
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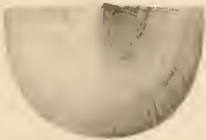
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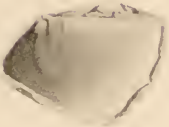
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Bulletin of the Museum of Comparative Zoölogy

AT HARVARD COLLEGE.

VOL. LXVIII. No. 7.

BIRDS COLLECTED BY DR. JOSEPH F. ROCK IN
WESTERN KANSU AND EASTERN TIBET.

BY OUTRAM BANGS AND JAMES L. PETERS.

WITH FIVE PLATES.

CAMBRIDGE, MASS., U. S. A.:

PRINTED FOR THE MUSEUM

AUGUST, 1928.

No. 7.—*Birds Collected by Dr. Joseph F. Rock in Western Kansu and Eastern Tibet.*

BY OUTRAM BANGS AND JAMES L. PETERS.

INTRODUCTION

In the spring of 1925 Dr. Joseph F. Rock was commissioned by the late Professor Charles S. Sargent, Director of the Arnold Arboretum, to make an extensive trip into western China and to visit certain forest areas in search of botanical and horticultural material. Thanks to the generous interest of Dr. Thomas Barbour, Dr. Rock was enabled to take with him his two trained Chinese bird collectors.

The expedition was in the field from April 1925 until the autumn of 1926. For much of that time the work was carried on under extremely trying conditions, intertribal wars, open hostility towards the whites by some of the Tibetan tribes, and bandits interfering much with his movements. In spite of all these drawbacks Dr. Rock and his Chinese assistants collected over 1000 birds, which after passing through many delays, and Chinese civil wars, reached this country in perfect condition without the loss of a feather.

It must be clearly understood that bird collecting was entirely a secondary consideration with Dr. Rock; his visits to any locality and the length of stay there were governed entirely by the botanical aspect of the situation.

Dr. Rock has made a map, which we have seen and studied, of the whole region that he traversed, which certainly was badly in need of accurate mapping. This he expects to publish.

The photographs were taken by Dr. Rock and are published here by permission of the Arnold Arboretum.

Entering Kansu from northern Szechuan in April 1925, Dr. Rock proceeded up the Wutu and Minchow rivers to Choni, in the Tao River valley. He collected in the region about Choni during May and June, making a trip to Mt. Lieuhoashan between Choni and Titao in July; during August he visited the Minshan range. In September he crossed the Tibetan border and collected around Lake Kokonor, later moving north into western Kansu where he explored the northern slopes of the Richthofen and North Kokonor Barrier ranges in late September, October and November, returning to Choni to spend January, February and March 1926. In the spring he set out westward, crossing

once more into Tibet, and collecting during May and June in the Ba valley, the Jupar mountains and the Yellow River gorges near Radja. Sometime during the summer he made a hurried reconnaissance of the great sacred mountain of Amne Machin, but was prevented from doing any work there by the open hostility of the Golock tribesmen. Returning to Choni late in the summer, he crossed the Minshan range and spent late August, September and early October in the Tebbu country. This region is not indicated on any published map. Rock speaks of an "upper Tebbu country" and a "lower" or "Ha Tebbu country." In the Tebbu lands Rock collected in the forests of Pezlu, Drakana, Mayaku, Sambaku and Wantsang Ku.

In many instances we have not been able to reconcile Dr. Rock's orthography of Chinese place names with the spelling on modern maps; we have however, preserved his spelling in every case.

We find that the sexing of the Chinese taxidermists is not dependable, and have been obliged to disregard it entirely in many cases.

We are indebted to the authorities of the United States National Museum and the American Museum of Natural History for the loan of necessary specimens, and to Mr. N. B. Kinnear of the British Museum of Natural History: and to Dr. Herbert C. Robinson for comparing some of our material with types in the British Museum.

The sequence of families in this paper is that of Sharpe's Hand List, with two exceptions. Following the recent consensus of opinion we recognize the *Prunellidae* as a distinct family. We also follow Sushkin and remove the genera *Passer* and *Montifringilla* from the *Fringillidae* to the *Ploceidae*.

TETRAONIDAE

TETRASTES SEWERZOWI SEWERZOWI Przew.

Tetrastes Sewerzowi Przewalski, Mongol i. Strana Tangut, 2, 1876, p. 130, pl. 18 (Kansu mountains in the lower and middle mountain ranges).

The Kansu Hazel Hen is represented in the collection by a fine series of sixteen examples including adults, immature and chicks. There are three males and a female from the spruce forests between 9,500 and 11,000 feet altitude in the Tao valley near Choni, collected during May and June 1925. One of the males taken in June has begun the post-nuptial moult, the renewal of the feathers is most conspicuous on the head, throat and neck, though a few pin feathers are noted elsewhere on the anterior portions of the dorsal and lateral tracts;

wings and tail are as yet unmoulted. Two adult females and three chicks were collected on Mt. Lieuhoashan, between elevations of 10,500 and 11,000 feet. Two adult males, an adult female and two immature were secured in the spruce forests of Drakana, upper Tebbuland, altitude 9,500 feet, during September 1926; the female and one of the males have shed the tail, and some of the fresh inner primaries are about one quarter grown. Two females collected in October 1925 at 11,500 feet in the mountains of Babo are in fresh autumnal plumage, the feathers of the upper parts being broadly veiled with olive brown, while below the veiling is buffy anteriorly and white posteriorly.

Riley's *Tetrastes sewerzowi secunda* (Auk, 42, 1925, p. 423 near Tatsienlu, Szechuan), of which we have three skins, is a valid race. None of our examples of *s. sewerzowi* show the characters that distinguish *secunda*. We mention this as Riley had but a single specimen of the former race on which to base his comparison.

PHASIANIDAE

TETRAOPHISIS OBSCURUS (Verreaux)

Lophophorus obscurus Verreaux, Nouv. Arch. Mus. Paris, Bull. 5, 1869, p. 33, pl. 6 (eastern Tibet = Mupin, Szechuan).

Rock collected two specimens of this rare pheasant in the Maerku valley, Tao River basin, south of Choni. The two birds, both sexed as females by the Chinese taxidermist, were obtained in forests, one in June and the other in December 1925.

TETRAOGALLUS TIBETANUS PRZEWALSKII Bianchi

Tetraogallus tibetanus przewalskii Bianchi, Aves Exp. Koslowi Mongol. u Tibet or. 1907, p. 165 (eastern Tibet).

In May 1925 a male was secured at an elevation of 11,500 feet on the cliffs at Peshingai, beyond Taochow in southwestern Kansu; a juvenal about half grown was collected on talus slopes at 13,500 feet, high alpine zone of the Minshan range. Six adults were obtained in eastern Kokonor; four of them (two males and two females) on the rocky exposed slopes 12,000 to 13,000 feet; on the mountains south of the Yellow River opposite Radja, a male at 13,000 feet on the high rocky slopes of the Waro valley 4 June 1926, and a male at 14,500 feet on talus in the Totuchnira pass over the Jupar range, 2 July 1926.

ALECTORIS GRAECA PUBESCENS (Swinh.)

Caccabis chukar var. *pubescens* Swinhoe, P. Z. S., 1871, p. 400 (northern China to the upper Yangtse).

In May 1925 a single specimen was taken in a rocky mountain gorge of the Wutu River, north of Kaichow, altitude 4,600 feet; five more examples, adults and immature, were secured during September 1926 at an elevation of 7,000 feet on dry slopes above Wantsang gomba, Ha Tebbuland. A female collected in October 1925 along a gravelly stream in the Liyuan Ku valley, Richthofen range, we also refer to this subspecies although the bird is slightly paler above than specimens of *pubescens* from eastern China. It is completing the autumnal moult and the wing feathers are not fully grown out.

ALECTORIS GRAECA MAGNA (Przewalski)

Caccabis magna Przewalski, Mongol i. Strana Tangut, 2, 1876, p. 127 (south Kokonor mountains, northern Tibet and Tsaidam plains).

All the rock partridges collected in Kokonor belong to this very distinct form that some ornithologists regard as a species. Seven adults of both sexes were taken in the Yellow River valley near Radja between 12 and 26 May 1926. They were found on grassy slopes and rocky hills at altitudes varying from 10,000 to 11,500 feet.

A male obtained in the valley of Sining, 7,800 feet in September 1925 apparently extends the range of this bird into western Kansu; the specimen is in worn plumage and stained with red earth or sandstone and for these reasons is not comparable with topotypical examples. It is labelled as having the eyes brown, whereas the birds comprising the series from eastern Kokonor are variously labelled as having the eyes yellowish gray, clay colored, yellow clay color or yellow.

PERDIX HODGSONIAE SIFANICA Przew.

Perdix sifanica Przewalski, Mongol i. Strana Tangut, 2, 1876, p. 124 (alpine regions of Kansu).

Rock secured thirteen specimens of this Partridge in western Kansu, eastern Kokonor and in the Minshan range, all of them belonging to the same race. A female and two three-quarter grown young birds were taken in October 1925 at 10,000 feet on the grasslands of Peitattung; on October 5 four immature examples were collected in eastern Kokonor on the summit of a pass at 11,000 feet between Tangar and Machuang Ku; and an adult with the autumnal moult incomplete

was shot between 11,000 and 12,000 feet in the Laliku Gorge, Tangar-Kokonor divide.

In the region about Radja three males were collected during May 1926 where the species was found in spruce forest and grassy clearings; the alpine regions of Kwanke-shan, 12,500 feet on the Yangtze-Yellow River divide yielded two specimens — an adult female and an immature male, in October 1926.

ITHAGINIS SINENSIS SINENSIS David

Ithaginis sinensis David, Ann. Sci. Nat. **18**, art. 5, 1873, p. 1 (Shensi).

Dr. Rock sent back a fine series of this splendid Blood Pheasant. Thirteen adults were secured near Choni in the spruce and fir forests of the Tao River valley at altitudes ranging from 10,000 to 11,000 feet. While on Mt. Lieuhoashan in July 1925 he collected three adults, and three chicks about a week old. During September 1926 two adults were secured in the spruce and fir forests in the Laliku valley 9,500–10,000 feet, northern slopes of the Minshans; two more adults in the juniper forests of Pezlu, upper Tebbu country, at 9,000 feet, and an immature female in spruce forest of Sambaku, 10,000 feet, Ha Tebbu-land.

ITHAGINIS SINENSIS MICHAËLIS Bianchi

Ithaginis sinensis michaëlis Bianchi, Ann. Mus. Zool. St. Petersb. **8**, 1903, p. 4 (northern foothills of the Nanshans).

Two males and a female of this rare and very distinct race were taken in November 1925 in spruce forest at 9,000 feet on Mt. Nginsinshan (Bullock Heart Mountain), a mountain in the north Kokonor Barrier range facing the southern end of the Richthofen range.

The males are paler than *s. sinensis* both above and below; wing edgings more rusty and less reddish, and there is much more green on the shaft streaks of the wing coverts, long scapulars and the feathers of the posterior upper parts. The female is a much paler and more smoky gray than the corresponding sex of *s. sinensis*. Wing of males 205 and 220; that of female 210.

CROSSOPTILON AURITUM (Pallas)

Phasianus auritus Pallas, Zoogr. Rosso-Asiat. **2**, 1827, p. 86 (interior of China).

One of the outstanding features of Dr. Rock's collection is a series of eleven adults and three chicks of this magnificent bird. It was not uncommon in the North Kokonor Barrier range where he obtained

four males and two females at 9,000 feet on Mt. Nginsinshan in October 1925. He shot a pair 15 May 1926 in the juniper forests of the Serchen gorge, 10,500 feet altitude, 1 day east of Radja, eastern Tibet, and on 28 May 1926 collected a male and two females in spruce forest at 11,000 feet south of the Yellow River opposite Radja. The three chicks were found on 25 June 1926 at 11,000 feet in spruce forest on the mountains west of the Jupar valley; they were not over three or four days old.

In addition to the specimens listed above, the collection contains the skin of a female raised in captivity at Choni, where this bird is reared from eggs taken from the nests of wild stock found in the mountains of southwestern Kansu. From the captives the middle tail feathers, which are in demand as ornaments for the headgear of the Mandarins, are pulled out.

Rock's wild killed birds all have the ornamental middle tail feathers, which are lacking in the Choni example.

PUCRASIA XANTHOSPILA Gray

Pucrasia xanthospila Gray, P. Z. S., 1864, p. 259, pl. 20 (hills northwest of Pekin).

Two females were taken at an elevation of 7,500 feet in the scrub oak forests of Mayaku, Ha Tebbuland in September 1926. In the absence of any comparative material of either *P. x. xanthospila* or *P. x. ruficollis* David and Oustalet (Ois. Chine, 1877, texte, p. 408, Shensi) we cannot comment on these birds. Kleinschmidt and Weigold (Abh. u. ber. Mus. Dresden, 16, 1923, no. 2, p. 4) question the validity of the latter form.

PHASIANUS COLCHICUS SOHOKHOTENSIS Buturlin

Phasianus strauchi sohokhotensis Buturlin, Ibis, 1908, p. 576 (oasis of Soho-Khoto, near Tshen-fan, 100 km. from the northern slopes of the eastern Nan Shan).

Dr. Rock sent in a female pheasant from the Liyüan Ku valley in the Richthofen foothills, where the bird was shot during November 1925 in willow scrub along a stream at an elevation of 7,000 feet.

This specimen is too pale for *P. c. strauchi*, of which we have a single female for comparison, and is rather too dark for *P. c. sat-scheuensis* Pleske, the race inhabiting the southern Gobi desert and westernmost Kansu of which we also have a female for comparison. We can find no description of the female of *sohokhotensis*, but infer that our bird is referable to that form, on geographic grounds.

PHASIANUS COLCHICUS STRAUCHI Przew.

Phasianus strauchi Przewalski, Mongol. i. Strana Tangut, **2**, 1876, p. 119, pl. 17 (Kansu mountains up to 10,000 feet).

According to Dr. Rock, Strauch's pheasant is very common in the Tao valley, but unfortunately he did not secure a series; a spring male with traces of a white collar was preserved, also a male shot during February 1926. Two chicks about ten days old from the Kadjaku valley, 9,500 feet, collected during August 1925, are doubtless referable to this race.

PHASIANUS COLCHICUS SUËHSCHANENSIS Bianchi

Phasianus suëhschanensis Bianchi, Bull. Ac. imp. Sc. St. Petersb. (5) **24**, 1906, p. 83 (Sungpan Szechwan).

The three specimens of pheasant from lower Tebbuland are certainly referable to this race. An adult female collected in September 1925 at 8,500 feet in the forests of Wantsangku agrees with a female in the Museum of Comparative Zoölogy from the upper Min valley in Szechuan, which may be considered topotypical. Two males taken September 1926 at 8,000 feet in the fields or scrub forests of Mayaku are moulting from the juvenal to the first winter plumage, but enough of the latter has appeared to make certain that these birds, too, belong to *suëhschanensis*.

COLUMBIDAE

COLUMBA LEUCONOTA GRADARIA Hart.

Columba leuconota gradaria Hartert, Nov. Zoöl., **23**, 1916, p. 85 (Sungpan, Szechwan).

Two males and a female of this pigeon were secured in June and August, 1925 amidst the snow fields and rocks on the summit of Mt. Kwang Kei (12,500 feet) in the western part of the Minshan range near the Kansu-Tibet border. During July of the same year three additional specimens were taken in the valley of Shiaoiku, 10,500 feet, where the birds frequented larch forests and adjacent meadows. A seventh example, a female, was collected at 8,000 feet in the forest of Mayaku, Ha Tebbuland, September 1926.

We have carefully compared these skins with a series from Szechuan and can detect no differences at all.

COLUMBA RUPESTRIS RUPESTRIS Pall.

Columba Oenas ♂ *rupestris* Pallas, Zoogr. Rosso-Asiat. 1, 1827, p. 560 (Dauria).

This pigeon was met with in southern Kansu along the Wutu River north of Kaichow at 4,000 feet where three females were secured in May 1925, and again in eastern Tibet where a male was collected at 11,500 feet 30 May, and a female 2 June 1926 on rocky cliffs among the junipers in the Sakatu ravine; two females were obtained a few days later at 11,000 feet in the meadows of the Shala valley.

COLUMBA sp. (domestic variety)?

Two very dark rock pigeons, ♂ and ♀, were taken along the Wutu River, elevation 3,000 feet, south Kansu, in April 1925.

These birds are slaty-black all over with much iridescence on the neck and crop region. They do not agree with the description of Buturlin's *nigricans* of inner Mongolia, being too dark. We suspect, of course, that they are domestic birds gone wild.

COLUMBA HODGSONI Vigors

Columba hodgsoni Vigors, P. Z. S., 1832, p. 16 (middle Himalayas).

One of the surprises of the collection was a fine pair of these birds obtained at 9,500 and 10,000 feet in spruce forest on Mt. Lieuhoashan (between Taochow and Titao) in July 1925.

So far as we know, this constitutes the first Palaearctic record for the species. The two specimens are identical with Yunnanese examples, except that the female has a reddish nasal operculum.

STREPTOPELIA ORIENTALIS ORIENTALIS (Lath.)

Columba orientalis Latham, Ind. Orn. 2, 1790, p. 606 (China).

An adult female was secured near Laliku (8,600 feet) in the Tao River valley, July 1925; in September 1926 an immature female was taken at 8,500 feet in the forests of Wantsang Ku.

OENOPELIA TANQUEBARICA HUMILIS (Temm.)

Columba humilis Temminck, Pl. col. livr. 44, 1824, pl. 259 (Bengal, Luzon).

There is one female in the collection taken in the Kokonor grass country, 11,000 feet, facing the eastern sand dunes, September 1925.

This bird is very different from examples of the corresponding sex from Hupeh and Yunnan, but we cannot describe it as a new form from a single specimen, somewhat immature, with an uncompleted moult.

LARIDAE

STERNA HIRUNDO TIBETANA Saund.

Sterna tibetana Saunders, P. Z. S., 1876, p. 649 (Tibet).

The capture of five specimens of this Tern near the Kansu-Tibet border constitutes an extension of its range. On 10 May 1926 an adult male was shot at an elevation of about 11,250 feet on the grasslands bordering the Tsechu stream, four days west of Labrang, and on 28 July a pair of adults and two well-grown juvenals were secured at 11,800 feet on grasslands at Amnyi Gardang, about halfway between Radja and Labrang.

The juvenals are like examples of *S. h. hirundo* of the same age except that they are much darker above. This is a very distinct form, the adults recognizable at a glance by their much darker coloration both above and below.

LARUS ICHTHYAËTUS Pall.

Larus Ichthyaëtus Pallas, Reise versch. Prov. Russ. Reich, **2**, 1773, p. 713 (Caspian Sea).

An adult female in the plumage of the second winter was shot in September 1925 along the southern shore of Lake Kokonor. A note on the label indicates that the irides are "grey" and the tarsi "lead colored"; these observations do not agree with the colors of these same soft parts given by Dr. Dwight in his monograph (Bull. Am. Mus. Nat. Hist. **52**, 1925 art. 3, p. 256-260).

LARUS BRUNNICEPHALUS Jerd.

Larus brunnicephalus Jerdon, Madras Journ. Lit. & Sci., **12**, 1840, p. 225 (India).

A single specimen of the Indian Brown-headed Gull was obtained at about the same time and place as the foregoing species. The bird is a female in plumage of the second winter. The label describes the irides as "pale gray" and the bill and legs as "red."

CHARADRIIDAE

VANELLUS VANELLUS (Linn.)

Tringa Vanellus Linné, Syst. Nat. ed. 10, **1**, 1758, p. 148 (Europe, Africa = Sweden).

The Lapwing was secured only during October 1925. A male was collected in swamps near Kanchow, western Kansu, and a male and a

female in a little grassy valley between the Nanshan ranges. These birds were doubtless migrants from further north.

CHARADRIUS DUBIUS CURONICUS Gm.

Charadrius curonicus Gmelin, Syst. Nat. 1, pt. 2, 1789, p. 692 (Curonja).

A female Little Ringed Plover was taken during May 1925 in the bed of the Wutu River one day north of Kaichow. This specimen still has obsolete rusty edges on the feathers of the back.

CHARADRIUS PLACIDUS Gray

Charadrius placidus Gray, Cat. Bds. Mamm. etc., of Nepal & Tibet in Brit. Mus., ed. 2, 1863, p. 70 (Nepal).

A female in very worn and abraded plumage was taken along the Tao River near Choni in June 1925.

IBIDORHYNCHA STRUTHERSII Vigors

Ibidorhyncha Struthersii Vigors, Proc. Comm. Zoöl. Soc. 1, 1831, p. 174 (Himalaya).

During June and July 1925 Dr. Rock encountered this species at rather low altitudes in the Tao River valley and its tributaries near Choni; taking a pair in the Kwadjaku valley at 9,600 feet, and two females in a small lateral valley at 8,600 feet. In December of the same year a male was secured in the valley of Payenrung, north of the Yellow River, at 10,000 feet. A male was obtained along the Yuvaku stream at 9,000 feet in the Drakana district of upper Tebbuland, September 1926.

SCOLOPACIDAE

TOTANUS TOTANUS EURHINUS Oberh.

Totanus totanus eurhinus Oberholser, Proc. U. S. Nat. Mus. 22, 1900, p. 207 (Tso Moriri Lake, Ladak).

Dr. Rock collected six Redshanks; three breeding adults and three autumnal specimens. Of the former a pair was secured on 10 May 1926 along the banks of the Taechu (11,200 feet) 4 days west of Labrang, and a female in the Ba valley at 9,500 feet, July 1926, where the species was encountered in swampy meadows. The autumn birds were taken in September 1925 at 10,700 feet along the south shore of Lake Kokonor.

Oberholser described *Totanus totanus eurhinus* from Ladak on the basis of larger size. Ticehurst in the *Ibis* for 1924, p. 120-121 upheld Oberholser's name, and with a series of both spring and winter birds from northwestern India before him pointed out certain color characters, in addition to the mensural ones, by which he believed the Indian birds could be differentiated. Still more recently, however, Colonel and Mrs. Meinertzhagen, (*Bull. B. O. C.*, 46, 1926, p. 85) after an examination of seven breeding birds from Ladak conclude that the difference in size between Ladak birds and those from western Europe is only average, and that the coloration is identical, but find that the form still further east differs in precisely the same color characters as pointed out by Ticehurst (whose note the Meinertzhagens' do not mention), as well as average larger size. They, therefore, regard Oberholser's name as a synonym of *t. totanus*, and name the form from further east *terrignotae*, with their type specimen from Kokonor.

To clear up the situation we borrowed the type and three other Ladak specimens from the U. S. National Museum. After a careful comparison with European material as well as with birds from Kokonor and eastern Tibet, we are convinced that the bird Oberholser described is the eastern Redshank. Regardless of what the breeding bird of Ladak may be, the type is as extreme as any of the rusty examples that we have seen, while the three paratypes though not quite as extreme, have more rufous above than in European examples. Our Kokonor skins agree in color with the type of *eurhinus*, but are slightly redder than the paratypes. The type and one paratype of *eurhinus* were taken on July 29; the third specimen is merely labelled "July," while the fourth was taken on the 15th of August. Considering the lateness of the dates, it is wholly possible that the birds were migrants and not the breeding form of the region.

In any event *terrignotae* must fall as a direct synonym of *eurhinus*.

ACTITIS HYPOLEUCOS (Linn.)

Tringa Hypoleucos Linné, *Syst. Nat.* ed. 10, 1, 1758, p. 148 (Sweden, apud Hartert).

This common, wide ranging species is represented in the collection by an immature male collected in September 1925 on the grass lands bordering Lake Kokonor.

PISOBIA TEMMINCKII (Leisl.)

Tringa Temminckii Leisler, *Nachtr. zu Bechstein's Naturg. Deutschl.*, 1812, p. 67-73 (Hanau am Main, Germany).

A male Temminck's Stint in juvenal plumage was obtained along the south shore of Lake Kokonor in September 1925.

PHALAROPODIDAE

LOBIPES LOBATA (Linn.)

Tringa tobata (sic = *lobata*) Linné, Syst. Nat. ed. 10, **1**, 1758, p. 148 (Hudson Bay).

Dr. Rock shot a female of this phalarope along a stream in the Mayaku district of the lower Tebbu country in September 1926.

MEGALORNITHIDAE

MEGALORNIS NIGRICOLLIS (Przew.)

Grus nigricollis Przewalski, Mongol. i. Strana Tangut, **2**, 1876, p. 135 (Kokonor).

A male of this splendid crane was taken at 10,900 feet on the Kokonor swampy meadows in September 1925; a second example, also a male was shot 10 May 1926 at 11,300 feet on the banks of the Tsechu River, 4 days west of Labrang. A note on the label of the latter specimen indicates that the eyes were white.

THRESKIORNITHIDAE

NIPPONIA NIPPON (Temm.)

Ibis Nippon Temminck, Pl. col., 1835, pl. 551 (Japan).

The Japanese Ibis was secured only in southern Kansu, here a male was shot along the Wutu River, one day north of Kaichow in May 1925, where it was nesting in trees along the river. In February 1926 two additional specimens were obtained in the same valley.

All three birds are in the white phase of plumage.

ARDEIDAE

ARDEA CINEREA JOUYI Clark

Ardea cinerea jouyi Clark, Proc. U. S. Nat. Mus., **32**, 1907, p. 468 (Seoul, Korea).

The eastern Asiatic race of the Gray Heron was found nesting in the poplar trees bordering the Wutu River in southern Kansu. An adult

male was secured there in May 1925. An adult female was shot along the Tao River near Choni in July 1925 and an immature female was taken at about the same place in October 1926.

These birds are like examples from Szechuan and Hupeh, having the neck less grayish and the middle and greater wing coverts paler than European specimens of typical *cinerea*.

ANATIDAE

ANSER ANSER (Linn.)

Anas anser Linné, Syst. Nat. ed. 10, **1**, 1758, p. 123 (Sweden, apud Hartert).

Rock found the Gray Goose in the fields along the Tao River valley near Minchow in the spring of 1925, where he collected a male. Another male was secured in September 1925 on the east shore of Lake Kokonor.

ANSER INDICUS (Lath.)

Anas indica Latham, Ind. Orn. **2**, 1790, p. 839 (India).

A male bar-headed goose was taken 23 May 1926 on the Yellow River at Radja, eastern Tibet. The skin is labelled as having the "iris gray, pupil bluish black."

TADORNA TADORNA (Linn.)

Anas Tadorna Linné, Syst. Nat. ed. 10, **1**, 1758, p. 122 (Sweden, apud Hartert).

A female Sheld-duck was shot on the Wutu River, north of Kaichow in April 1925.

CASARCA FERRUGINEA (Pall.)

Anas ferruginea Pallas, Vroegs, Cat., Adumbr. 1764, p. 5 (Tartary).

The Ruddy Sheld-duck is represented in the collection by a single specimen, a female, collected on the Tao River below Choni in September 1926.

ANAS CRECCA Linn.

Anas Crecca Linné, Syst. Nat. ed. 10, **1**, 1758, p. 125 (Sweden, apud Hartert).

Two Teal, both of them males either in immature or eclipse plumage, were collected during September 1925. One on the southern shore of

Lake Kokonor, the other along a small stream between Sining and Taerhssu (Kumbum).

We believe that *Anas crecca* and *Anas carolinensis* should be regarded as distinct species.

SPATULA CLYPEATA (Linn.)

Anas clypeata Linné, Syst. Nat. ed. 10, **1**, 1758, p. 122 (restricted type locality, South Sweden, apud Hartert).

A mated pair of Shovelers was taken on the Minchow River in southwestern Kansu during April 1925.

MERGUS MERGANSER ORIENTALIS Gould

Mergus orientalis Gould, P. Z. S., 1845, p. 1 (Amoy).

This merganser appears to be a permanent resident in southwestern Kansu. In June 1925 an adult female and a duckling about three weeks old were secured on the Tao River near Choni, while another female was taken there in January 1926 and a male the following month. A female in very worn plumage was collected 23 June 1926 in the Ba valley, eastern Tibet, at an elevation of 9,900 feet. A male was taken in December 1925 along the Tapetchüen River between Sincheng and Sining.

All the adults have the more slender bill, supposed to be characteristic of the east-Asiatic race of *Mergus merganser*.

PHALACROCORACIDAE

PHALACROCORAX CARBO SINENSIS (Shaw & Nodd.)

Pelecanus sinensis Shaw and Nodder, Nat. Misc. **13**, 1801, pl. 529 and text (China).

While Rock was at Lake Kokonor in September 1925, he collected three cormorants. In March and April 1926 he shot two more on the banks of the Tao River near Choni. One of these is a female in late winter plumage with the ornamental feathers on head and neck fully grown in.

We thoroughly agree with Ticehurst that *P. c. sinensis* and *P. c. subcormoranus* (Brehm) are identical, though we regret that Brehm's name, of which the type is still in existence, must be relegated to synonymy. Now that the Common Cormorant of Europe must be called *sinensis*, this seems an opportune time to point out once more the fallacy of bestowing geographic names.

AEGYPIIDAE

AEGYPIUS MONACHUS (Linn.)

Vultur monachus Linné, Syst. Nat. ed. 12, 1, 1766, p. 122 (Arabia).

A female of this large vulture was collected at the end of November in the valley of Peitaitung, 10,000 feet, in the eastern Nanshan ranges.

Lönnberg (Ibis, 1924, p. 322) lists specimens of *Gyps himalayensis* Hume from the Tibet-Kansu border, but Rock did not secure that species.

FALCONIDAE

(Owing to the differences of opinion as to the families of Hawks and their limits we follow the arrangement of Sharpe's Hand List.)

ACCIPITER NISUS MELANOSCHISTUS Hume

Accipiter melanoschistus Hume, Ibis, 1869, p. 356 (Simla).

An adult female Sparrow Hawk collected at 11,000 feet in the spruce forests near Choni, May 1925 probably represents the breeding bird of the Tao valley. She is very dark, almost black above and without doubt referable to *melanoschistus*. An immature male collected in December 1925 near the Chinssu Lamasery, 10,000 feet, south of Labrang is likewise much darker than corresponding examples of *nisosimilis* from different parts of China, as are three males, one of them fully adult, from the forest of Drakana 9,500 feet October 1926.

BUTEO BUTEO JAPONICUS Temm. & Schl.

Falco buteo japonicus Temminck and Schlegel, in: — Siebold's Faun. Jap. Aves, 1844, p. 16; 1845, pl. 6 and 6 b (Japan).

A specimen of the Japanese Buzzard was taken at Kadjaku (9,000 feet elevation) in the Tao valley, 13 January 1926.

BUTEO FEROX HEMILASIUS Temm. & Schl.

Buteo hemilasius Temminck and Schlegel, in: — Siebold's Faun. Jap. Aves, 1844, p. 16; 1845 pl. 7 (Japan).

An adult was taken in May 1925 on Tibetan grasslands at 11,000 feet in southwestern Kansu; this specimen appears to be a male, since the wing measures but 450 mm.; tarsal feathering is short and sparse

(especially on the distal portion), a condition doubtless due to season. A female taken in the mountains beyond Obo in extreme northeastern Kokonor has a wing of 495 mm., the tarsal feathering is long and dense, as is also the same character in another winter example—a female from Kadjaku, Tao River valley, collected in January 1926. The latter bird has a wing of 485 mm. The plumage of this example is pale, especially on the nape and sides of the head which are largely white; the rusty edgings on the anterior upperparts are also pale.

We cannot see that Streseman has made out a clear case (Abh. u. ber. Mus. Dresden, 16, 1923, no. 2, p. 61) for the recognition of *B. f. leucocephalus* Hodgs.; his measurements mean nothing, and the alleged color characters are of no value in a bird so notoriously variable.

GYPÆTUS BARBATUS GRANDIS Storr

Gypætus grandis Storr, Alpenreise, 1784, p. 69 (Switzerland).

A male, not quite adult, was taken just east of Lake Kokonor, September 1925. The bird was shot while feeding on the carcass of a yak. In the region of the Yellow River gorges in eastern Tibet three birds, two adults and an immature, were secured during the spring of 1926 as follows—one on sandstone cliffs near Dzangar 15 May; one on the sandstone cliffs of the Serchung valley, 16 May; and one on cliffs in the Waro valley, 20 June.

AQUILA CHRYSÆTOS DAPHANEA Menzb.

Aquila daphanea Menzbier, Orn. Turkestan, 1, 1888, p. 75 ("High Asia").

A Golden Eagle was taken 25 April 1926 on the Tibetan grasslands 11,000 feet between Ankor and Hetzu (southwestern Kansu?).

We refer this specimen to *daphanea* on geographic grounds, though the bird has a wing measurement of only 655 mm. Because of its dark coloration our specimen might possibly be referred to *A. c. obscurior* Sushkin, but there are certain discrepancies, notably in the color of the tarsal feathering, that we cannot reconcile.

CIRCAËTUS GALLICUS (Gm.)

Falco gallicus Gmelin, Syst. Nat., 1, pt. 1, 1788, p. 259 ("Gallia").

A male in worn plumage was taken on the grasslands of Hetso, 9,000 feet, in April 1926.

This species was not found by Sjölander, Weigold or Zappey in western China which leads us to believe that the bird is rare there.

HALIÆTUS LEUCORYPHUS (Pall.)

Aquila leucorypha Pallas, Reise Versch. Prov. Russ. Reich, 1, 1771, p. 454 ("Iaikum").

Two examples of this Eagle, one partly adult, the other immature, were collected at 11,000 feet in the western hills of Kokonor grass country in September 1925. A splendid adult was shot on the south shore of Lake Kokonor also in September. The latter bird had the eyes "clear crystal, outer part of pupil reddish" and the legs "pale flesh color."

MILVUS LINEATUS (Gray)

Haliaetus lineatus Gray, in:—Hardwick's Ill. Ind. Zoöl. 1, 1832, p. 1, pl. 18 (China).

An adult male of this Kite was secured 23 June 1926 at 10,000 feet in the Ba valley. In August of the previous year two males and a female were taken in a deep rock gorge leading south through the Minshan range into the Tebbu country.

FALCO SUBBUTEO SUBBUTEO Linn.

Falco Subbuteo Linné, Syst. Nat. ed. 10, 1, 1758, p. 89 (Sweden, apud Hartert).

An adult female, together with three large young, the latter just ready to leave the nest, was collected in September 1925 in the Sining valley.

We have not enough material to discuss the Asiatic forms of *Falco subbuteo*, but whatever may be the status of *centralasiae* Buturlin, our birds certainly do not belong to that race. The adult female is identical in color with European examples and has a wing of 261 mm. The three juvenals are exactly like a young female, probably only a few days older, collected in Holland in late August.

FALCO CHERRUG MILVIPES Jerd.

Falco milvipex Jerdon, Ibis, 1871, p. 240 (Umballa, India).

Two examples of this fine falcon were secured in November 1925. The first was taken on the banks of the Kanchow ho, north of the Kanchow Nanshan mountains, at an elevation of 5,500 feet; the other at the foot of the Nanshans at the entrance to the Pientuku gorge.

FALCO TINNUNCULUS INTERSTINCTUS McClell.

Falco interstinctus McClelland, P. Z. S. for 1839; 1840, p. 154 (Assam).

A single adult female Kestrel was secured in the mountains of Pikow, 6,000 feet, in southern Kansu, just over the Szechuan border, late April or early May 1925.

The two most recent revisers of the Kestrels (Rothschild, Nov. Zool. **33**, 1925, p. 231-232) (Stuart Baker, Bull. B. O. C. **47**, 1927, p. 102-107) are not entirely in accord in their treatment of the Asiatic races of that species. According to the former, *interstinctus* is identical with *japonicus*, but different from *saturatus* with which it had previously been united, while the latter maintains all three races as distinct. From Stuart Baker's account however we judge that *japonicus* is only very slightly different from *interstinctus*, the characters appearing only in the male. Our single female is clearly not *tinnunculus*, and we refer it to *interstinctus*, which is probably the correct name for it, whether *japonicus* (1844) is identical with *interstinctus* (1839) or not.

BUBONIDAE

BUBO BUBO subsp.

A nestling Eagle Owl was taken near Choni in May 1925. Neither parent was secured. The bird is still too young to show any diagnostic characters. The distribution of the central Asiatic forms of *Bubo bubo* is not sufficiently well known to identify this bird subspecifically even on geographic grounds.

ATHENE NOCTUA IMPASTA subsp. nov.

Type.—Adult female, No. 239416 Mus. Comp. Zool.; grass country south of Lake Kokonor, 10,700 feet; collected September 1925 by Joseph F. Rock (orig. no. 408).

Characters.—Similar to *A. n. plumipes*¹ (*Athene plumipes* Swinh., P. Z. S. 1870, p. 448, Shato, north China) in having feathered toes, but much darker; pale markings on the top of the head linear rather than guttate; light tail bands interrupted; markings below darker and more extensive.

Measurements

Number	Sex	Wing	Tail	Tarsus
239416	♀ (type)	167	108	38
239417	♀	168	102	34
239418	♀ (♂?)	157	91	34

Athene noctua plumipes from Shansi

87567	♀	166	92	34.5
87568	♀ (♂?)	155	85	35

Of the specimens of our new form listed, in addition to the type, one was secured on the grasslands at the head of the Serchen valley (13,300 feet) three days east of Radja, 26 July 1926; and the third was taken in May 1925 in the forests covering the slopes of the mountains of Choni (9,000 feet). The latter specimen as might be suspected on geographic grounds, is somewhat intermediate between *impasta* and *plumipes*. It approaches the latter in having the light tail spots almost forming bands, but tends toward the former in the extent of the streaking below and in having linear pale crown-stripes — on the whole it is best placed with *impasta*.

We have not seen *Athene noctua ludlowi* Stuart Baker of southern Tibet, but that form is said to be about the color of *A. n. plumipes*. Our new form is much darker, in fact but little paler than *A. noctua noctua* of Europe. Our bird also comes from a region that is quite different faunally, and although we hesitated at first, we now see no course open but to name it.

CUCULIDAE

CUCULUS CANORUS BAKERI Hart.

Cuculus canorus bakeri Hartert, Vög., Pal. Faun. **2**, heft, 7, 1912, p. 948 (Shilong).

Cuckoos were taken in the region about Choni during May and June 1925 in willow, spruce and poplar forests; a juvenal female in the red phase was secured in spruce forests at 10,000 feet on Mt. Lieu-hoashan in July 1925. An adult was shot in the Yellow River gorges near Radja, 20 May 1926 and another in the willows of the Ba valley 23 June 1926.

We have come to exactly the same conclusion in regard to these cuckoos that Lönnberg (Ibis, 1924, p. 318) reached concerning birds from Aschuen and the Minshans. Our two from eastern Tibet are larger than the Tao River birds, but the entire series falls within the limits of the dimensions given for *bakeri* by its author.

CUCULUS INTERMEDIUS INTERMEDIUS Vahl

Cuculus intermedius Vahl, Skriv. af Nat. Selskab. Kjöbenhavn, **4**, 1789, p. 58 (Tanquebaria).

A female of this cuckoo was taken at 10,000 feet in the Choni mountains 25 June 1925.

PICIDAE

PICUS CANUS GUERINI (Malh.)

Chloropicus Guerini Malherbe, Rev. et Mag. Zool., 1849, p. 539 (China).

During April and early May 1925 while Dr. Rock was traveling north through southern Kansu he shot four males and a female of this woodpecker in the mountains (6,000 feet) south of Pikow. Five more were secured near Choni: a male in very worn plumage at 9,000 feet, May 1925, two immature in spruce forest at 9,000 feet in the valley of Tayüku, and two females, also in spruce forests, in February 1926.

Upon comparing these specimens with an adequate series of *Picus canus* (upwards of forty specimens) from Hupeh, Szechuan, Anwhei, and Kiangsu, we do not see how *P. c. jacobsii* (LaTouche) (Bull. B. O. C. 41, 1919, p. 50, Chang-yang hsien, Hupeh) and *P. c. setschuanus* Hesse (Orn. Monatsb., 1911, p. 193, Tatsienlu) can be maintained. There is not a single constant character by which we can distinguish them, and the minor differences visible are due either to age, season, wear, stain or individual variation. La Touche in describing *jacobsii* made direct comparison with *ricketti* from Fokien instead of with *guerini* from the lower Yangtze valley. Our ten topotypes of *jacobsii* cannot be distinguished from twelve examples of *guerini* collected in Kiangsu, Anwhei and the Yangtze valley near Hupeh.

Five specimens from Omeih sien, Kwanhsien, and Dcheto, western Szechuan, do not bear out the characters assigned to *setschuanus* by its describer or subsequently by Rensch; with the exception of one unusually dark female, we can match them bird for bird with our series of *guerini*. Likewise Rock's ten birds listed above can be matched skin for skin by *guerini* and we, therefore, place both *jacobsii* and *setschuanus* in the synonymy of *guerini*.

Lönnberg had a single specimen from the Minshans that he identified as *sordidior* (Rippon).

DRYOBATES MAJOR STRESEMANNI Rensch

Dryobates major stresemanni Rensch, Abh. u. ber. Mus. Dresden, 16, no. 2, 1923, p. 38 (Tsaliea, western Szechuan.)

Dryobates major beicki Stresemann, Orn. Monatsb. 35, 1927, p. 134 (Lan-hukou, northern Kansu).

Dr. Rock sent in a series of fourteen specimens of the Great Spotted Woodpecker from a number of localities in Kansu. Early in May 1925 he collected a pair at 5,000 feet altitude in the mixed forest between

Pikow and the Szechuan border; later in the same month two males and three females in the poplar forests along the Tao River near Choni, a male among willows and poplars in the Choni forests in June 1925, a female in the mountains of Choni between 9,000 and 10,000 feet, 4 June 1925; a female was taken in spruce forest in the Tao River valley in February 1926. In December 1925 two females were collected at 7,000 feet in the valley of the Yellow River near Shunhoa. The region north of the Nanshans is represented by two males taken on the Kan-chow plain 6,000 feet in November 1925.

We do not recognize *beicki*, because among the birds collected by Rock, which include skins from both south and north of the type locality of *beicki*, supplemented by material from Szechuan and Yunnan, we find a great deal of variation in the color of the underparts, independent of season; some of the birds from Kansu are as dark as the darkest specimens of *stresemanni* from western Szechuan, others again are but little darker than *cabanisi* (series of 30 from Hupeh, Anwhei and Kiangsu examined). *Stresemanni* can be distinguished from *cabanisi* by the character of the marking on the two outer pairs of tail feathers and by the generally browner tone of the underparts, but any further separation based on the latter character alone cannot, in our opinion, be maintained.

DRYOBATES PERNYII PERNYII Verreaux.

Picus pernyi Verreaux, Rev. et Mag. Zool. 1867, p. 171 (nomen nudum), p. 271 (orig. descr.), pl. 16 (north China).

An adult female of this rare woodpecker was taken at 6,000 feet in April 1925 near Chingchuan in the forests of northern Szechuan.

Compared with two examples from Hupeh, we find this bird to be much browner on the forehead, sides of head, neck and throat; flanks browner and more heavily streaked; the black spot on the breast much larger and extending onto the abdomen; the light bars on the tail are browner and less buffy, besides being more restricted. In all particulars except the extent of the black on the under parts, the skin agrees with that of a male from the Lichiang range 10,000 feet, in Yunnan (Am. Mus. Nat. Hist. 143341, Andrews and Heller).

Verreaux in his introduction to the catalogue of the collection made by Mgr. Perny states that the birds in that collection came from the north of China; but since Mgr. Perny was Bishop of "Su-tchuen," it is practically certain that his birds came from Szechuan. The plate is not colored with sufficient accuracy to determine exactly whether the

dark form of western China, or the much paler race from Hupeh is the one figured; on the whole, however, it agrees much better with the darker bird and we designate Szechuan as the type locality; for the race inhabiting Hupeh we propose the name:—

DRYOBATES PERNYII INNIXUS subsp. nov.

Type.—Adult male; No. 52287 Mus. Comp. Zool. from Chang Yang Hsien, Hupeh; collected 24 January 1909 by W. R. Zappey.

Characters.—Similar to *D. p. pernyi* Verr. but the sides of head and neck, throat, flanks and light tail bars much paler, (buffy, not brownish), streaks on sides and flanks narrower, becoming obsolete posteriorly; black tail bars narrower.

Measurements

<i>D. p. pernyi</i>	♂	Wing, 106;	Tail, 77	Bill, 21
	♀	" 105	" 78	" 21
<i>D. p. innixus</i>	♂	" 107	" 78	" 22
	♀	" 106	" 77	" 20

PICOIDES TRIDACTYLUS FUNEBRIS Verr.

Picoides funebris Verreaux, Nouv. Arch. Mus. Paris, Bull. 6, 1870, p. 33 (mountains of Chinese Tibet = western Szechuan).

A pair of adults was collected at 10,000 feet in the spruce forest on Mt. Nginsinshan, northern slopes of the north Kokonor Barrier range, in September 1925. This record marks a still further extension of this bird's range. Formerly known to occur only in the mountains of western Szechuan, Rothschild records it from the Mekong-Salwin divide and the Lichiang range, northwestern Yunnan, and Lönnberg has a specimen from the Minshans.

DRYOCOPUS MARTIUS KHAMENSIS (Buturl.)

Picus khamensis Buturlin, Ann. Mus. Zool. Ac. Imp. St. Petersburg. 13, 1908, p. 229 (eastern slopes of the great plateau of Tibet).

Rock sent in a series of seven specimens of the Black Woodpecker. A male from Babo in spruce forest at 10,000 feet, north slope of the north Kokonor Barrier range, October 1925; a female taken in a like location and altitude near Choni May 1925; a female from spruce and fir forest at 10,000 feet south of the Minshans near the Tibet-Tebbu-

land border, June 1925, and four from the forests of Drakana, 9,800 feet, upper Tebbuland, September 1926.

We can detect no differences between any of these specimens; they are all referable to *khamensis* by reason of their less feathered tarsi and slightly smaller bills. These birds also appear much deeper black, than does *D. m. martius* when a series of each is laid side by side. It is quite possible, however, that this difference may be due to the relative freshness of the skins, and that it would tend to disappear if recently killed specimens of both forms were compared.

JYNX TORQUILLA PALLIDIOR Rensch.

Jynx torquilla pallidior Rensch., Abh. u. ber. Zool. Mus. Dresden, **16**, 1923, no. 2, p. 40 (Tatsienlu, Szechuan).

Five examples, an adult male and four adult females of this well-marked race were collected in southwestern Kansu during May and June 1925. One of them was taken at 9,000 feet in the mountains of Choni, the others on the grasslands en route to Hetso and on the loess cliffs northwest of Choni and Taochow.

HIRUNDINIDAE

DELICHON URBICA CASHMERIENSIS (Gould)

Chelidon cashmeriensis Gould, P. Z. S., 1858, p. 356 (Cashmir).

A single house martin was taken at an elevation of 9,500 feet in the forest of Drakana, September 1926.

RIPARIA RUPESTRIS (Scop.)

Hirundo rupestris Scopoli, Annus, **1**, Historico-Nat. 1769, p. 167 (Tirol).

The crag martin is represented in the collection by one specimen taken on the rocky cliffs of the Wutu River gorge in southern Kansu, May 1925.

HIRUNDO DAURICA DAURICA Linn.

Hirundo daurica Linné, Mantissa, 1771, p. 528 (Siberia).

An adult taken during May 1925 in the Tao valley near Choni is referable to this form, being narrowly streaked below with no trace of shaft stripes on the rufous brown rump, and the wing measuring 124 mm.

MUSCICAPIDAE

MUSCICAPA SIBIRICA ROTHSCHILDI (Stuart Baker)

*Hemichelidon*¹ *sibirica rothschildi* Stuart Baker, Bull. B. O. C. **43**, 1923, p. 156 (Lichiang range, northwestern Yunnan).

A male was collected at 10,000 feet in the Kwadjaku valley, Minshan range in June 1925; this specimen must represent the breeding form of the region. The bird is so much darker than specimens of *cacabata* Penard from Szechuan collected by Zappey, that we cannot do otherwise than refer it to the form recently described by Stuart Baker from northwestern Yunnan.

Rothschild (Nov. Zoöl. **33**, 1926, p. 294) refers two adults and four immature *Muscicapa sibirica* in the La Touche collection from Mengtsze, Yunnan, to *rothschildi*. One of the adults and all of the immature are now before us; they are typical *Muscicapa sibirica* just as La Touche identified them in his paper on the birds of southeast Yunnan (Ibis, 1923, p. 380).

MUSCICAPA PARVA ALBICILLA Pall.

Muscicapa albicilla Pallas, Zoogr. Rosso-Asiat. 1827, p. 462 (Dauria).

A male was secured in the mountains of Choni, at 9,000 feet in May 1925.

MUSCICAPA TRICOLOR CERVINIVENTRIS (Sharpe)

Digenea cerviniventris Sharpe, Cat. Bds. Brit. Mus. **4**, 1875, p. 460 (Manipur Hills).

Rock sent in three examples of this rare little flycatcher. In June 1925 a male was collected at 9,500 feet in the mountains of Choni; during late September or early October 1926 a male and female were secured in the forests of Wantsang Ku at 8,500 feet elevation.

These birds agree with a series from southeastern Yunnan in the La Touche collection that are certainly *cerviniventris* and not *tricolor*. Rothschild allocates La Touche's Mengtzse birds as *tricolor*, apparently because birds from the Lichiang range belong to that form quite regardless of the wide faunal disparity between the two places.

¹ We follow Hartert in rejecting most of the genera into which *Muscicapa* has been divided.

MUSCICAPA HODGSONII (Verr.)

Siphia Hodgsonii Verreaux, Nouv. Arch. Mus. Paris, Bull. 6, 1870, p. 34 (mountains of Chinese Tibet = Mupin).

This species was found in the region about Choni during May and June 1925 in the spruce and poplar forests at elevations between 8,500 and 10,000 feet, where four males and two females were secured. In September 1926 the species was met with abundantly in the forests of Wantsang Ku. Here seventeen specimens were taken: five adult males, four adult females, and nine juvenals, either entirely in the spotted plumage, or moulting into the olive immature dress. The juvenals agree with Weigold's description (Abh. u. ber. Mus. Dresden 15, no. 3, 1922, p. 26) except that in none of our nine specimens is there any trace of white at the base of the tail.

SEICERCUS BURKII VALENTINI (Hart.)

Cryptolopha burkii valentini Hartert, Vög. Pal. Faun. 1, heft 4, 1907, p. 497. (Taipaishan).

This species was taken only in the lower Tebbu country during September 1926. One was secured at 9,000 feet in the forests of Mayaku and seven more in the forests of Wantsang Ku. We have no means of telling whether these birds were migrants or represent the breeding form of the region. One was moulting the wings, otherwise the length of wing in the series is 58; 59; 59; 60; 62; 64.

Weigold had difficulty in placing the birds he collected in western China, but referred them—some, however rather doubtfully—to *tephrocephala* (Anderson).

With a long series, which includes all the skins from the La Touche collection, before us, we believe there is a large northern form, *valentini*, and a small southern form, *tephrocephala*. We cannot appreciate the characters other than size claimed by Hartert to distinguish the two races. The case, however, is much complicated by the fact that the females are constantly smaller than the males, although the sexes are alike in plumage. Thus females wrongly determined as males by the collector, might entirely obscure the facts. Rock's Chinese bird collector made so many palpable mistakes, even in spring and summer and with birds where the sexes are different in plumage, in determining the sex of specimens, that we place no reliance whatever upon the sex marks on his labels.

As the larger birds in the present series have the long wing of *valen-*

tini, we are forced to assume that all belong to that form and that the larger ones are males and the smaller ones females. The other alternative would be to throw *valentini* and *tephrocephala* together; this we are not yet quite prepared to do.

CAMPOPHAGIDAE

PERICROCOTUS BREVIROSTRIS ETHOLOGUS Bangs & Phillips

Pericrocotus brevirostris ethologus Bangs and Phillips, Bull. M. C. Z. **58**, no. 6, 1914, p. 283 (Hsien Shen, Hupeh).

Two males of this minivet were taken at 9,000 feet in the forests near Choni during May 1925. In September 1926 three males were secured in the spruce and pine forests of Wantsang Ku at 9,000 feet, and a male and two females at 8,500 feet in the oak and pine forests of Mayaku.

These birds are quite the same as the Hupeh bird of which we have five males and two females available for comparison in addition to a bird from Peking and three migrants from southeastern Yunnan. Stuart Baker's description of *styani* (Bull. B. O. C. **40**, 1920, p. 117) is very vague; he did not appreciate any characters in the male except to say that it might "perhaps" be paler below than in *affinis*, while the characters he attributed to the female are very variable ones. Lacking material from Szechuan we cannot express any definite opinion, but we rather suspect, that *styani* will prove synonymous with *ethologus*. Unfortunately Stuart Baker made no comparison with *ethologus*, apparently having overlooked the fact that the Hupeh bird already bore a name.

PYCNONOTIDAE

SPIZIXOS SEMITORQUES SEMITORQUES (Swinhoe)

Spizixus semitorques Swinhoe, Ibis, 1861, p. 266 (Peling plateau near Amoy).

Dr. Rock collected a pair of this bulbul in southern Kansu. The birds were shot at an elevation of 4,500 feet in the bushes along the Minchow River between Kaichow and Minchow in May 1925. As far as we are aware this is the first record of the occurrence of this bird in Kansu.

Spizixos cinereicapillus (Swinhoe) of Formosa, we consider only subspecifically distinct from *semitorques*.

TIMALIIDAE

IANTHOCINCLA DAVIDI DAVIDI (Swinhoe)

Pterorhinus davidi Swinhoe, Ibis, 1869, p. 61 (Peking).

Seven examples of David's Babbler were secured in the general region about Choni during May and June 1925 and again in January 1926. The birds were met with at elevations between 8,500 and 10,000 feet in scrub forest or low bushes, usually along streams.

We have available for comparison but two examples of *I. d. concolor* Stresemann (J. f. O. **71**, 1923, p. 365, Sungpan, western Szechuan) both from the type locality. Of *I. d. davidi* we have over twenty-five specimens from Shansi and Chihli measuring as follows:—

♂ wing 86–94; bill from base 26–27.5

♀ wing 83–94; bill from base 25–29

The skins collected by Rock measure:—1 ♂, wing 90; bill from base 26. 6 ♀ ♀, wing 88–91; bill from base 25–29.

We cannot find the slightest difference either in color or size between birds from northeastern China and those from southwestern Kansu, and whatever *I. d. funebris* Stresemann (Orn. Monatsb. **35**, 1927, p. 134, Lan-hu-kou, northern Kansu) may be, our specimens are certainly true *davidi*. *I. d. concolor* appears to be a localized race in western Szechuan, characterized by longer wing and shorter bill.

We follow Rothschild¹ in combining the so-called genera *Trochalopteron*, *Babax*, *Kaznakowia*, *Ianthocincla* and *Pterorhinus*, as we fail to see where any line can be drawn between them, but believe that *Garrulax* should be retained as a distinct genus, as Hartert² kept it.

IANTHOCINCLA DAVIDI EXPERRECTA subsp. nov.

Type.—No. 238760 Museum of Comparative Zoölogy, adult female, from Liyuan Ku, northern slopes of the Richthofen range, elevation 7,000 feet. Collected November 1925, by J. F. Rock (orig. no. 453).

Characters.—Similar to *I. d. davidi* but larger, coloration much clearer and paler gray; black and white of the loreal feathers more contrasted; bill longer, stouter and more decurved.

¹ Nov. Zoöl. **33**, 1927, p. 398.

² Pal. Faun. **1**, p. 624.

Measurements

<i>Sex</i>	<i>Wing</i>	<i>Bill from base</i>
♂	95	27
♀	100	30 (Type)
♀	95	29
♀	96	29

In addition to the type, Rock secured the three specimens listed above, at the same time and place.

As will be seen, the measurements exceed those already given for *dauidi*. Comparison with birds from Chihli taken in November and from southwestern Kansu collected in January shows that the pale gray tone of the plumage of the new form is not seasonal, but is definitely correlated with mensural characters. The examples of typical *dauidi* at our disposal are all distinctly brownish gray. This race is not *I. d. funebris* Stresem. (Orn. Mon. **35**, Sept. 1927, p. 134, Lan-hu-kou, northern Kansu), whatever that bird may be.

IANTHOCINCLA SUKATSCHEWI (Berezowski and Bianchi)

Trochalopteron Sukatschewi Berezowski and Bianchi, Aves Exp. Potan, Gansu, 1891, p. 59, pl. 1, f. 1 (coniferous forests, high mountains of Kansu).

Rock collected a pair of this rare babbler in February 1926 in a lateral valley of the Tao River near Choni, the slopes of which were covered with willow scrub and spruce.

IANTHOCINCLA ELLIOTII PERBONA subsp. nov.

Type (and only specimen).—No. 238772 Museum of Comparative Zoölogy, adult male, from Liyuan Ku, northern slopes of the Richthofen range, elevation 7,000 feet. Collected November 1925 by J. F. Rock (orig. no. 452).

Characters.—Similar to *I. e. elliotii*, but the mantle slightly darker; white terminal spots and dusky subterminal bands of the feathers of the upper parts larger; sides of head, throat, and chest darker, much more blackish gray, and white marginings broader; bill heavier; feet and tarsi stronger.

Remarks.—This form agrees more nearly with *elliotii* than with *prjewalskii*, in having the central rectrices greenish above. The white edgings on the anterior under parts and on the mantle of *I. e. elliotii* wear off rapidly, but our new form shows a greater development of this character, when compared with specimens of *elliotii* from Hupeh

taken in November, December and January. The effect of the dorsal markings gives a speckled effect not to be seen in any examples of either *elliottii* or *prjevalskii* that we have examined. The eye is noted on the label as being "watery." Hartert quotes "dunkel zimmetfarben," for the color of the eye in *I. e. elliottii*.

IANTHOCINCLA ELLIOTII PRJEVALSKII (Menzbier)

Trochalopteron prjevalskii Menzbier, Ibis, 1887, p. 300 (Kansu).

Two females were taken in low bushes on hillsides on the mountains of Minchow in southern Kansu at an elevation of 5,000 feet during May 1925. In May, June and July 1925 the species was met with on the mountains of Choni and along the upper Tao valley. The two examples of each sex taken here were in bushes, near the ground.

The gray (instead of greenish) pair of central rectrices seems to be the only certain character by which *I. e. prjevalskii* can be distinguished from *I. e. elliottii*. Apparently *Ianthocincla elliottii* abrades its plumage very rapidly, and fresh examples are uncommon. The additional characters enumerated by Lönnberg (Ibis, 1924, p. 314) for separating the two forms seem to us to be due to wear, and the larger bill that he claims for *prjevalskii* is not borne out in our series.

IANTHOCINCLA MAXIMA (Verreaux)

Pterorhinus maximus Verreaux, Nouv. Arch. Mus. Paris, Bull. 6, 1870, p. 36, pl. 3, fig. 1 (mountains of Chinese Thibet).

This fine babbler was very common locally. Rock secured twelve specimens as follows:—four males and two females during February 1926 in the valley of the Tao River basin in the region about Choni. Two males and a female in June 1925 in spruce and fir forest on the southern slopes of the Minshan range in the Tebbu country. Two males in the forests of Drakana, upper Tebbu country, 9,500 feet, September 1926. One immature male at 9,600 feet on Mt. Lieuhua (shan) south of Lanchow, July 1925.

IANTHOCINCLA CANORA-NAMTIENSIS (La Touche)

Trochalopteron canorum namtiense La Touche, Ibis, 1923, p. 317 (nom. nov. pro *T. canorum yunnanensis* La Touche, nec. *T. elliotti yunnense* Rippon, Howkow, Yunnan).

One male from the mountain of Minchow, 5,000 feet elevation, May 1925.

The single specimen secured does not differ materially from birds from Yunnan and Hupeh.

IANTHOCINCLA SANNIO (Swinhoe)

Garrulax sannio Swinhoe, Ibis, 1867, p. 403 (Amoy).

Dr. Rock took an adult female of this bird in the mountains of northern Szechuan, 6,000 feet altitude, during April 1925.

FULVETTA CINEREICEPS FESSA subsp. nov.

Type.— No. 238787 Museum of Comparative Zoölogy, adult male, from the Choni spruce forests, Tao River basin, southwestern Kansu, 9,000 feet, February 1926. Collected by J. F. Rock, original no. 586.

Characters.— Similar to *Fulvetta cinereiceps cinereiceps* (Verreaux) but darker above, much less reddish, more olivaceous on the back, rump and upper tail coverts; sides of head and neck darker gray; flanks much more olivaceous, less ochraceous. Size as in *cinereiceps*.

In all twelve specimens of this tit-babbler were taken — two males and a female from the region about Choni during January and February 1926; six males and two females from the forests in the Wantsang Ku valley, Ha Tebbuland, September 1926, in spruce, fir and maple at an elevation of 8,500 feet; one female in the juniper forests of Pezlu, banks of the Chulungapu, upper Tebbuland, elevation 7,200 feet, September 1926.

We have had a great deal of difficulty in determining exactly what *F. c. cinereiceps* is. It was first described by Verreaux (*Siva cinereiceps*, Nouv. Arch. Mus. Paris, Bull. 6, 1870, p. 37, "mountains of Chinese Tibet") in a rather unsatisfactory Latin diagnosis. Later David and Oustalet (*Les Oiseaux de la Chine*, 1877, text p. 220, Atlas, pl. 73) state that the types came from Moupin, and append a careful description based apparently on examples taken on the Tsinling range in Shensi. This latter description was translated literally in the Catalogue of Birds of the British Museum 7, 1883.

We consider as practically topotypical a series of six birds collected by Zappey in west-central Szechuan (May, June, September, October) and can detect no difference between them and a series from Hsien Shanhsien, Hupeh, taken in December. All of these birds have a lighter head and much redder back than our new form.

There is in the La Touche collection recently acquired by the Museum of Comparative Zoölogy, one of the nine cotypes of *Proparus fucatus* Styan (Bull. B. O. C. 8, 1899, p. 26; figured Ibis, 1899, pl. 4, f. 1).

One skin collected by Zappey in April at Ho Cha Ping, Hupeh, also belongs to this form. The Styan specimen is a juvenal; Zappey's is adult. These two birds agree with one another, and differ from all those we refer to *cinereiceps* in having more chestnut back and flanks; darker, more brownish crown; small bill, and especially in that the five inner primaries are wholly black and the secondaries lack the rufescent edging. In *cinereiceps* the sixth and seventh primaries are black, but the remaining three innermost, as well as the secondaries, are externally edged with brownish olive. In this pattern of the wing, *fucatus* agrees with *guttaticollis* (*Proparus guttaticollis* La Touche, Bull. B. O. C. 6, 1897, p. 50, Kuatun, northwestern Fokien). The plate of *fucatus* in the Ibis, however, shows the wing with the secondaries and three inner primaries edged with rufescent. If it were not for this, we should consider the status of *fucatus* definitely settled; as it is we hesitatingly apply this name to the breeding bird of the region about Ichang.

FULVETTA RUFICAPILLA RUFICAPILLA (Verreaux)

Siva ruficapilla Verreaux, Nouv. Arch. Mus. Paris, Bull. 6, 1870, p. 37 (mountains of Chinese Tibet).

A single specimen of this species — an adult female — was secured at Chingchuan in the mountains of northern Szechuan, elevation 5,000 feet, April 1925.

FULVETTA STRIATICOLLIS (Verreaux)

Siva striaticollis Verreaux, Nouv. Arch. Mus. Paris, Bull. 6, 1870, p. 38 (mountains of Chinese Tibet = Moupin, northern Szechuan).

Three fully grown juvenals were taken in the forests of Drakana, 9,500 feet elevation, upper Tebbuland, September 1926.

We fully agree with Stresemann (Abh. u. ber. mus. Tierk. Dresden 16, no. 2, 1923, p. 21) that *striaticollis* does not belong in the same "Formenkreis" with *guttaticollis*.

MYIOPHONUS CAERULEUS IMMANSUETUS Bangs and Penard

Myiophonus caeruleus immansuetus Bangs and Penard, Occ. Papers, Boston Soc. N. H. 5, 1925, p. 147 (Ichang, Hupeh).

Rock collected two males of this bird during September 1926 in the forests of Wantsang Ku, Ha Tebbuland, at elevations of 7,000 and 7,600 feet. Both specimens were shot along streams. They are fully adult and in the autumnal moult.

While we have retained this genus where Sharpe placed it, among the *Timaliidae*, we do so only for convenience, being convinced that in reality it belongs with the *Turdidae*.

LEIOTHRIX LUTEA LUTEA (Scopoli)

Sylvia lutea Scopoli, Del. Flor. et Faun. Insubr. **2**, 1786, p. 96 (hills of the province of Anwhei south of the Yangtse, designated as type locality by Stresemann, J. f. O. **71**, 1923, p. 364).

Two males and a female were taken in April 1925 at an elevation of 6,000 feet in the mountains of northern Szechuan in the forests along the Kansu border.

These examples agree with Stresemann's description of *Leiothrix lutea kwangtungensis* (J. f. O. **71**, 1923, p. 364, Suihang, Kwangtung) and with some specimens from Mengtsze, southeastern Yunnan. After careful comparison with a very large series of *L. lutea* from Szechuan, Hupeh, Fokien and southeastern Yunnan, we are struck with the fact that all the most deeply colored examples, regardless of locality, were collected in February, March, and April (Stresemann's type was taken in March), though not all the birds taken at that time are brightly colored.

However the "Japanese Robin" as is well known to bird fanciers, after a year or two of captivity usually loses its lipochrome pigment, with consequent dulling of yellows, oranges and reds, the result no doubt of deficiencies in its artificial diet. We believe it to be a corollary that unusual vigor in a wild individual, or particularly favorable food supply, would result in the temporary intensification, possibly only at certain seasons, of the lipochromes, producing such individuals as Stresemann has named *kwangtungensis*. We cannot find that *kwangtungensis* has any range of its own, individuals of its type of coloration occurring in various widely separated regions. We therefore cannot recognize *kwangtungensis*.

SUTHORA WEBBIANA SUFFUSA Swinhoe

Suthora suffusa Swinhoe, P. Z. S., 1871, p. 372 (middle Yangtse).

Rock collected two males of the Yangtse Crow-tit on the foothills of the mountains of northern Szechuan, altitude 3,000 feet, during April 1925.

The specimens do not differ in any way from comparable material from the Yangtse valley in the region of Hupeh. The occurrence of this race in northern Szechuan marks a considerable extension of its range to the north and west.

SUTHORA CONSPICILLATA CONSPICILLATA David

Suthora conspicillata David, Nouv. Arch. Mus. Paris, Bull. 7, 1871, p. 14 (easternmost Kokonoor).

Ten examples of this interesting *Suthora* were secured as follows: an adult from south of the Tao River, southwestern Kansu, June 1925, 9,500 feet; and nine from upper Tebbuland, 7,200 to 9,500 feet; September 1926. Of the latter one is an adult female, badly worn, the autumnal moult just commenced; an adult male and an adult female with the moult nearly complete; and six juvenals of both sexes.

These are the first specimens of true *conspicillata* from near the type locality that either of us have seen, and we find a very different bird from Hupeh, one secured at Hsien-tien-tsze by Zappey, and one from Ichang taken by Styan (in the La Touche collection) both labelled *conspicillata*. These agree with *conspicillata* in having a white eye-ring, but differ at once in being paler throughout with lighter brown head, and in having very much stouter bills with the culmen more arched. (See text figure below.) The much exaggerated bill of the Hupeh bird is very different from that of any of the small Chinese *Suthoras*, and is best characterized as a slightly reduced counterpart of that organ as developed in *Suthora unicolor*. We propose to call the Hupeh form

SUTHORA CONSPICILLATA ROCKI subsp. nov.

Type.—No. 50711 M. C. Z. from Hsien-tien-tsze, Hupeh, 6,000 feet altitude, adult ♂, collected 2 June 1907 by Walter R. Zappey.



Suthora c. conspicillata
M. C. Z. 238810
Kansu



Suthora c. rocki
Type, M. C. Z. 50711
Hupeh

The two skins afford the following measurements: — wing, 54 and 56; tail, 65; tarsus, 22; bill from base, 10; height of bill at base, 8 and 8.5.

In four adults of *S. c. conspicillata* the bill from base is 7.5–8; height of bill at base, 6–6.5.

The text figures above were drawn by Miss H. Saunders and are twice the natural size of the specimens.

TROGLODYTIDAE

NANNUS TROGLODYTES IDIUS (Richmond)

Olbiorchilus fumigatus idius Richmond, in: – Research in China, 1, pt. 2, Carn. Publ. no. 54, p. 498 (Wang-kuai-chon, Chihli).

Five wrens were taken along the Yellow River gorges in eastern Kokonor:—an adult female, 13 May 1926, in spruce forest, 10,300 feet, two days above Radja, and two males and two females on rocky cliffs or in juniper forests of the Sakutu Ravine, 10,500 feet, 1 June 1926.

After comparison with a fine series from northeastern Chihli we are unable to separate this series, all the birds in somewhat worn plumage, from *idius*, but it is of course possible that birds from eastern Kokonor in fresh plumage might reveal some differences.

Rock also secured two fully grown juvenals in August 1926 in the forests of Doyaya, Ha Tebbuland, and one intermediate between juvenal and immature plumage in August 1925 in the Minshan range at 12,000 feet elevation. These three specimens are not sufficiently mature to offer diagnostic characters, but are very dark below, agreeing with two juvenals of *szetschuanus* collected by Zappey in western Szechuan, and probably are referable to that race.

CINCLIDAE

CINCLUS CINCLUS CASHMERIENSIS Gould

Cinclus cashmeriensis Gould, P. Z. S., 1859, p. 494 (Kashmir).

The Kashmir Dipper was secured in every region that Rock visited, a series of ten being taken. A male and two females were collected during May and June 1925 at elevations of 8,500 feet in the Tao valley near Choni; a male at 10,000 feet in the Minshan range, July 1925; a pair in the Jupar valley, 11,600 feet, June 1926; an adult male at 8,000 feet in the forests of Wantsang Ku, Ha Tebbuland, September 1926; a juvenal male and a juvenal female, 8,000 feet, in the forests of Maya Ku, Ha Tebbuland; and a female in the Kanglungssu valley, Richthofen range, 8,000 feet, November 1925. This last specimen

appears somewhat larger and darker with a slightly longer bill than the specimens from Kansu and Kokonor, but it may be wrongly sexed, since its size can be approached by some males from further south, and the difference in color is so slight that it may well be an individual variant.

CINCLUS PALLASII SOULIEI Oustalet

Cinclus Pallasi var. *Souliei* Oustalet, Ann. Sc. Nat. Zool. (7), **12**, 1892, p. 299 (Tatisien Lu and Moupin).

A male and two females were taken in the mountains of Chingchuan, northern Szechuan, near the Kansu border. The date and altitude have both been omitted from the labels.

TURDIDAE

TURDUS CASTANEUS GOULDII (Verreaux)

Merula Gouldii Verreaux, Nouv. Arch. Mus. Paris, Bull. **6**, 1870, p. 34 (western Szechuan and Moupin).

Eight adults of both sexes were taken in southwestern Kansu in the region about Ch'oni between May and July 1925. The birds were always found among willows or in bushes beside the streams. Four juvenals from Mt. Lieuhoashan and the valley of Tayuku, collected in July 1925, were taken in forests of spruce and fir between 9,000 and 10,000 feet.

A fully grown juvenal was secured during September 1926 at 9,600 feet in the Drakana forest, upper Tebbuland, while an adult male was killed at 7,500 feet in shrubs and bushes on the outskirts of the forests of Wantsang Ku, Ha Tebbuland, September 1926.

We can detect no difference between the specimens here listed and topotypical material from western Szechuan.

TURDUS MUPINENSIS MUPINENSIS Laubmann

Turdus mupinensis Laubmann, Orn. Monatsb. **28**, 1920, p. 17 (Nom. nov. pro *Turdus auritus* Verreaux, nec Gmelin, Moupin).

Two males and a female, all in transition from juvenal to immature plumage, were taken during September 1926 in the forests of Wantsang Ku, 8,000 to 8,500 feet, Ha Tebbuland.

TURDUS RUFICOLLIS RUFICOLLIS Pallas

Turdus ruficollis Pallas, Reise Verch. Prov. Russ. Reich. **3**, 1776, p. 694 (Dauria).

Three birds, collected by Rock in May 1925 doubtless represent wintering birds that had not yet moved north. All were very fat. A male was collected in scrub forest, 5,000 feet elevation near Minchow; a male and a female were taken at 10,000 feet in the scrub forest of the Tao valley near Choni.

TURDUS RUFICOLLIS ATROGULARIS Temminck

Turdus atrogularis Temminck, Man. d'Orn. **1**, 1820, p. 169 (Austria and Silesia).

In February 1926 Rock shot a female of the black-throated thrush in spruce forest on the southwest bank of the Tao River near Choni. Apparently this thrush seldom straggles on its migration so far east in China.

TURDUS KESSLERI (Przewalski)

Merula kessleri Przewalski, Mongol i. Strana Tangut, **2**, 1876, p. 62, pl. 10 (mountains of Kansu).

Thirteen specimens represent Kessler's Thrush in the collection. A male and a female were taken during May 1925 in the Tao valley, 9,000 to 10,000 feet, near Choni, where they occurred in "spruce forests and outskirts"; two more were secured in the spruce forests or on alpine meadows of the Minshan range in July 1925. Four males and two females were collected late in May 1926 in juniper forest at 11,000 feet altitude south of the Yellow River opposite Radja, Tibet; a female along a brook near the same place 30 May, a male (sexed as a female) in much worn plumage, Dachso canyon 10,500 feet, Yellow River basin, north of Radja 2 June; and a male along a stream in the upper Jupar valley, 11,500 feet June-July 1926.

MONTICOLA SOLITARIA PANDOO (Sykes)

Petrocincla pandoo Sykes, P. Z. S., 1832, p. 87 (The Ghauts, India).

One male was taken along a water course in the forests of Mayaku, Ha Tebbuland, 8,000 feet, September 1926.

ENICURUS SINENSIS Gould

Enicurus sinensis Gould, P. Z. S., 1865, p. 665 (Shanghai).

Two examples were taken near Chingchuan, northern Szechuan, in April 1925, where the species was always seen along rivers and wooded brooks. A third specimen, a male, was collected during September 1926 near Zhega, 8,500 feet, in the forests of Mayaku, Ha Tebbuland. It was just completing the autumnal moult.

CHAIMARRORNIS LEUCOCEPHALA (Vigors)

Phoenicura leucocephala Vigors, Proc. Comm. Zool. Soc. London, **1**, 1831, p. 35 (Himalaya).

Two males were secured in May 1925 near Choni, where Rock found the species common along streams. A third specimen, also a male, was taken 2 June 1926, on the Dachso stream, 10,500 feet, Yellow River drainage north of Radja, eastern Kokonor.

PHOENICURUS OCHRUROS RUFIVENTRIS (Vieillot)

Oenanthe rufiventris Vieillot, Nouv. dict. hist. Nat. **21**, 1818, p. 431 (India adopted as type locality by Hartert, Vög. Pal. Faun. **1**, p. 723).

Rock secured a series of twelve specimens of the eastern Indian redstart. A male and a female were taken during April 1925 at 5,000 feet in the spruce forest on the mountains of northern Szechuan near the Kansu border; a female in willow bushes along the Tao River, 5 June 1925; two females on Mount Lissedzadza 11,000 feet, Minshan range, July 1925, where the species was found in bushes and juniper forest. In eastern Kokonor two males were taken in spruce forest along the Yellow River gorges, 10,300 feet, five miles below the Dzangar monastery, 13 May 1926; two females in the Dachso canyon, Yellow River gorges, 11,000 feet, 1 June 1926; a female and two juvenals in the Dzomo valley, 11,800 feet, 22 June 1926.

PHOENICURUS HODGSONI (Moore)

Ruticilla hodgsoni Moore, P. Z. S., 1854, p. 26, Aves, pl. 58 (Nepal).

Six examples of Hodgson's Redstart were taken. A male in poplar forest, Tao River valley, 8,500 feet, May 1925; a male in the mountains of Choni south of the Tao River, 10,000 feet, June 1925; a female, spruce forests of Choni, 8,500 to 9,000 feet, February 1926. The species

was also met in eastern Kokonor where two males were taken in scrub or in bushes along the Yellow River near Radja in May 1926. An adult male, collected September 1926 in the forests of Mayaku, Ha Tebbuland, at an elevation of 8,000 feet, was just completing the autumnal moult, the fresh feathers on the breast are tipped with gray.

PHOENICURUS AUROREUS Pallas

Motacilla aurea Pallas, Reis. Versch. Prov. Russ. Reichs. **3**, 1776, p. 695 (Selenka, Lake Baikal).

A male was collected in evergreen forest on the mountains of northern Szechuan near the Kansu border in April 1925; a male in worn breeding dress was taken in the willow groves at 9,500 feet elevation on Mt. Lieuhoashan, Minshan range, 16 July 1925; an immature male in the juniper forests in the upper Tebbu country, 7,200 feet, September 1926, and an immature female in the forests of Wantsang Ku, 8,000 feet, lower Tebbu country, September 1926.

We believe that Stuart Baker is correct in reducing both *filchneri* and *leucopterus* to the synonymy of *aureus*.

PHOENICURUS ERYTHROGASTER MAXIMUS Kleinschmidt

Phoenicurus erythrogaster maximus Kleinschmidt, Abh. u. Ber. Mus. Tierk. u. Völk. Dresden, **16**, no. 2, 1923, p. 42 (Janeti, Rombatsa and Chuwo, eastern Tibet).

Eight specimens of this large redstart were taken: three males in forest and scrub at 11,000 feet altitude in the Rako gorge, eastern Kokonor, September 1925; a female at Babo 10,000 feet, north slope of the Kokonor Barrier range, September 1925; a male and two juvenals July 1926 on rocky cliffs below the Totuchsura pass, 14,300 feet elevation, Jupar range, a male in the spruce forests of Choni, shot in barberry bushes, February 1926.

The wing measurements of the five adult males are: 108, 106, 104, 106, 105; of the female 102. These measurements taken across the chord of the wing correspond with Kleinschmidt's 107 to 110.5 for males and 104 for the female, taken against the flattened wing.

The differences in sizes between *grandis* and *maximus* were first noted by Hartert (Vög. Pal. Faun. **1**, p. 727), though Kleinschmidt, when he named the latter form, did not give credit to that author.

PHOENICURUS FRONTALIS Vigors

Phoenicura frontalis Vigors, Proc. Comm. Zool., Soc. London, **1**, 1832, p. 172 (Himalaya).

Phoenicurus frontalis sinæ Hartert, Bull. B. O. C. **38**, 1918, p. 78 (mountains of China; type from Kansu).

The series of eighteen blue-fronted redstarts secured by Rock illustrates nearly every phase of plumage that this species undergoes. A male, shot in April 1925 in the mountains of northern Szechuan, still retains the rusty olive edgings on the feathers of the upper parts; two females were taken in the spruce forests on the mountains of Choni, 9,500 feet, in May and June; from the Minshan range we have two males in normal spring dress taken on the summit of Mt. Koang Kei, 13,000 feet June 1925, while a third example taken at the same time and place has but a sprinkling of blue feathers on the throat and breast, although the lesser wing coverts and some of the scapulars are blue; a worn adult female and two juvenals from the spruce and fir forests of Mt. Lieuhoashan 10,000–11,000 feet, July 1925; and four juvenals at the Rock Gate of the Minshans, July–August 1925.

In Kokonor two adult males in different stages of the autumnal moult were secured in September 1925 at 10,000 feet altitude in the Rako gorge; and a female was taken 22 June of the following year at 11,800 feet in the Dzomo valley.

From Tebbuland Rock sent an adult female, moult not yet commenced, taken at 9,500 feet in the forests of Drakana, and an adult in an advanced state of moult, taken at 8,500 feet in the forests of Wantsang Ku, both examples being collected in September 1926.

Most authors who have recently dealt with this species doubt the validity of *P. f. sinæ* Hartert, an opinion that we share.

PHOENICURUS SCHISTICEPS (Gray)

Ruticilla schisticps Gray, Cat. Mamm. Bds. Nepal Coll. Hodgson, 1846, p. 69 (Nepal).

Of the twenty examples of the white-throated redstart in the collection, five males and two females were secured in the region about Choni during May and June 1925 at altitudes ranging from 9,000 to 10,500 feet and in a variety of situations—spruce and open forest, and alpine meadows; during February 1926 two males and four females were secured in the same region at an elevation of about 9,000 feet, generally in forests. A male and a female were collected in the Kadjaku

valley, Minshan range, 9,500 to 10,500 feet in July and August 1925, where Rock states that the species was "a common bird." The specimens secured in Kokonor in 1926 are: a male on 2 June in the Dachso canyon north of Radja, a female 22 June on the rock slopes of the Dzomo valley, and a male on the 26th at 12,500 feet, on the northern slopes of the Jupar range. From Ha Tebbuland we have a juvenal, unfortunately not dated, taken at 8,500 feet in the forests of Wantsang Ku, and an adult male with the autumnal moult well begun, collected at 9,000 feet, forests of Sambaku, September 1926. Stresemann (Orn. Monatsb. 35, Sept. 1927, p. 134) has described *P. s. beicki* from Lan-hu-kou, northern Kansu, solely on the basis of slightly shorter wing-length. This variation is not borne out by our material, measuring with the wing flattened out on the rule, European fashion; the wings of 9 males from southwestern Kansu and eastern Kokonor are 82, 83, 83.5, 83.5, 84, 84, 84, 84, 85.5 and we, therefore, cannot bring ourselves to regard *beicki* as a valid subspecies, since the dimensions of that race as given by its describer are 81 to 83.5 for the male against 82-88 for the corresponding sex in typical specimens of *P. s. schisticeps*.

RHYACORNIS FULIGINOSA FULIGINOSA (Vigors)

Phoenicura fuliginosa Vigors, P. Z. S., 1836, p. 185 (Himalaya).

Sixteen specimens of the water redstart were secured. A female from the mountains of northern Szechuan, April 1925; two males from the mountains of Choni, 9,000 to 10,000 feet, June 1925, where the species was found along streams in the spruce forests. In the Minshans an adult male was secured in the Kadjaku valley, a juvenal from along the Drakana trail into Tebbuland, both in August 1925, and an immature in June 1925 in the forests of spruce and fir, 9,800 feet, on southern slopes of the mountains. During September 1926 the species was common in the forests of Wantsang Ku, Ha Tebbuland, where ten examples of both sexes, adults and immature were secured, without exception along streams.

We cannot recognize *R. f. tenuirostris* Stresemann, our extensive series proving that that form was based upon inconstant characters.

HODGSONIUS PHOENICUROIDES ICHANGENSIS Baker

Hodgsonius phoenicuroides ichangensis Baker, Bull. B. O. C. 43, 1922, p. 18, (Ichang, upper Yangtze valley).

Rock sent in four examples of this handsome species — a male and a female from the vicinity of Choni were secured beside brooks in the

forest during May 1925; a female apparently adult, in fresh autumnal plumage, taken in the forests of Mayaku, 8,000 feet, Ha Tebbuland, September 1925, and a specimen sexed as a male (and with the wing measurements of that sex) but in female livery, taken in the forests of Wantsang Ku at 8,500 feet, September–October 1926.

We have no topotypical material of *H. p. phoenicuroides* for comparison, but refer our specimens to *ichangensis* on the basis of the wing measurements, which are 70.5 and 71.5 in the two males. Baker gives 69 to 71 for the wing of Chinese birds as against 73 to 79 for Indian specimens.

CALLIOPE CALLIOPE (Pallas)

Motacilla Calliope Pallas, Reise Versch. Prov. Russ. Reich. **3**, 1776, p. 697 (Jenissei to the Lena).

Only five specimens of the ruby-throat were taken; two males and two females May and July 1925, from the region about Choni at 9,500 feet altitude, and a male at 10,000 feet in the Kadjaku valley, Minshan range, June 1925.

IANTHIA CYANURA (Pallas)

Motacilla cyanurus Pallas, Reise Versch. Prov. Russ. Reich. **2**, 1779, p. 709 (Jenissei).

A male was taken at 9,000 feet in the mountains of Choni, May 1925; a female in spruce forest at 10,000 feet, near Babo, northern slopes of the north Kokonor Barrier range, September 1926.

IANTHIA RUFILATA PRACTICA Bangs and Phillips

Ianthia practica Bangs and Phillips, Bull. M. C. Z. **58**, 1914, p. 292 (Loukou Chai, Yunnan).

Rock collected eight specimens of this bush robin. Two of these, a male and a female, were taken in the mountains of Choni in the spring (May and June) of 1925; a juvenal was secured on Mt. Lieuhoshan in the Minshan range, July 1925, and the remaining five — juvenals, immatures and a moulting adult — are from the forests of Tebbuland, all killed in September 1926.

The single adult male in our series agrees with the characters claimed by Riley (Proc. U. S. Nat. Mus. **70**, Art. 5, 1926, p. 39) for a male from the Taipeishan district of Shensi, which that author believes "prob-

ably represents a distinct form." However, there is a large amount of individual variation in the shade of blue of the upper parts and in the extent of white in the superciliary stripe, and we do not believe that these examples are in any way separable from the Yunnan bird.

SAXICOLA TORQUATA PRZEWALSKII (Pleske)

Pratincola maura var. *Przewalskii* Pleske, Wiss. Res. Przewalsky's *Reisen* Vög. 1, 1889, p. 46, pl. 4, fig. 1, 2 and 3 (Kansu).

A male was shot in the scrub bordering the gorge of the Wutu River, in southern Kansu, May 1925; in September of the same year a female was secured at 10,000 feet on Mt. Nginsinshan, near Babo, on the northern slopes of the north Kokonor Barrier range.

OENANTHE ISABELLINA (Cretzschmar)

Saxicola isabellina Cretzschmar, Atl. zu Rüppell's Reise, Vög. 1826, pl. 52, pl. 34, b. (Nubia).

A single female of this wide-ranging species was shot on 20 May 1926 on the grassy banks of the Yellow River at Radjagomba, 10,000 feet, eastern Kokonor.

OENANTHE PLESCHANKA PLESCHANKA (Lepechin)

Motacilla Pleschanka Lepechin, Nov. Comm. Pet. 14, 1770 (= 1771), p. 503, pl. 24 (Saratow, on the Volga).

This species was met at an elevation of 3,000 feet near Kaichow, south Kansu, where a male was killed beside the river bank during May 1925.

PRUNELLIDAE

PRUNELLA COLLARIS TIBETANUS (Bianchi)

Accentor collaris tibetanus Bianchi, Ann. Mus. Zoöl. Ac. Petersb. 9, 1904, p. 128 (east Tibet).

This species was met with only at great altitudes; a female was taken on the limestone crags at 13,000 feet altitude on Mt. Koang Kei in the Minshan range, June 1925; and two males at 14,600 feet, the highest point in the Jupar range, eastern Kokonor, June 1926.

PRUNELLA RUBECULOIDES BEICKI Mayr

Prunella rubeculoides beicki Mayr, Orn. Monatsb. **35**, Sept. 1927, p. 149 (Lan-hu-kou, northern Kansu).

Ten examples of the Robin Hedge Sparrow were secured as follows: a male and a female 21 September 1925 in the Laliku gorge, near Lalatapan in the Tangar-Kokonor Barrier range; a male and a female in October 1925 beyond the Tangar Mountains of Lassa, 10,000 feet elevation; a male and a female in November 1925 in the valley of Liyuan Ku near Hayotong, 6,000 to 7,000 feet, in the Richthofen range; a male in spruce forest and willow scrub on the outskirts of Choni, February 1926; a female on the grassy hills, Upper Dachso, north of Radja, 11,400 feet, 4 June 1926, and two females in spruce forest at 10,500 feet, gorges of the Yellow River, near Radja, June 1926.

Compared with specimens from Szechuan, our skins agree with Mayr's description in having a grayer head, and we therefore adopt his name from the birds from western Kansu and northeastern Tibet.

PRUNELLA STROPHIATA MULTISTRIATA (David)

Accentor multistriatus David, Ann. and Mag. Nat. Hist. (4), **6**, 1871, p. 256 (Mupin).

Rock collected a male in the Wutu Ho gorge, 4,000 feet, in southern Kansu, May 1925, a female in the mountains of Choni between 9,000 and 10,000 feet during June 1925, and two males and a female in the Tao valley, near Choni, February 1926. During August a juvenal female was taken on the alpine meadows at 12,500 feet of Mt. Kwanghei in the Minshan range. The species was apparently breeding in the eastern Kokonor country about Radja, where a male and two females were taken during June 1926 between 10,500 and 11,000 feet. A female in fresh immature plumage was collected in October 1926 on the grasslands of Peitatumg, 10,000 feet between Kokonor and the Liangchow Nanshan.

All these specimens agree closely with one another and with skins from western Szechuan.

PRUNELLA FULVESCENS NADIAE subsp. nov.

Type.— No. 238898 Museum of Comparative Zoölogy, adult male from the Tao River valley, near Choni, southwestern Kansu, 8,200 feet, February 1926, collected by J. F. Rock, original no. 548.

Characters.— Similar to *Prunella fulvescens khamensis* Sushk. and agreeing with that race in being strongly streaked above, but lacking the streaks on the upper tail coverts and on the sides.

When Professor Sushkin (Proc. Boston Soc. Nat. Hist. **38**, No. 1, 1925, p. 48–55) revised the forms of *Prunella fulvescens* he had seen but a single specimen from Kansu, a female from Old Tao Chow, in the British Museum. He noted the characters by which this example differed from *khamensis*, but hesitated to name it on account of the poor state of its preservation. The series of sixteen specimens listed below confirms the characters pointed out by Prof. Sushkin for the Kansu bird. We take great pleasure in naming the form for Mrs. Sushkin.

Two males and ten females were taken during February 1926 in the valley of the Tao River near Choni. In September 1925 a female in fresh autumnal plumage was shot in spruce forest at 10,000 feet elevation near Babo in the north Kokonor Barrier range. A female in somewhat worn dress was taken 13 May 1926 on grassy bluffs overlooking the Yellow River gorges two days above Radja and five miles below the Dzangar monastery. A male and a female, both slightly worn, were secured along the grassy banks of the Yellow River at Radja elevation 10,000 feet, 23 May 1926.

SYLVIIDAE

TRIBURA THORACICA PRZEVALSKII (Sushkin)

Dumeticola thoracica przewalskii Sushkin, Proc. Boston Soc. Nat. Hist. **38**, no. 1, 1925, p. 41 (Dshachar mountains, upper Hwang-ho).

Rock secured a male of this species at 11,500 feet in tall alpine grass on Mt. Lieuhoashan, Kansu, 16 July 1925. We have compared this specimen with the type of *davidi* (*Tribura thoracica davidi* La Touche, Bull. B. O. C. **43**, 1923, p. 168, Chinwangtao, northeastern Chihli) and with Sushkin's description of *przewalskii* (supra), and find that our bird belongs to the latter, though to us the two races appear to be very close.

PHYLLOSCOPUS AFFINIS (Tickell)

Motacilla affinis Tickell, Journ. As. Soc. Bengal, **2**, 1833, p. 576 (jungles of Borabhum and Dholbum).

One male was taken at 10,500 feet in a willow forest in the gorge of the Serchen stream, one day east of Radja, 16 May, 1926.

PHYLLOSCOPUS ARMANDII (Milne-Edwards)

Abroornis armandii Milne-Edwards, Nouv. Arch. Mus. Paris, Bull. **1**, 1865, p. 22, pl. 2, f. 1 (north China).

Twelve examples of this warbler were collected, three males and three females during May and June in the Tao River valley near Choni, where the birds haunted either willow or poplar forest or willow scrub; a female from the Kwadjaku valley in the Minshan range, June 1925; a female, spruce forest, 11,000 feet, Dachso canyon, Yellow River gorges north of Radja, 2 June 1926; a male in willow groves 9,900 feet along the Ba stream, 25 June 1926, and a male at 11,500 feet in the mountains opposite Radja, June 1926. During September 1926 a male was secured at 8,000 feet in the forests of Wantsang Ku, Ha Tebbuland, and a female at 9,500 feet, forest of Drakana, upper Tebbuland.

PHYLLOSCOPUS PROREGULUS PROREGULUS (Pallas)

Motacilla Proregulus Pallas, Zoogr. Rosso-Asiat. **1**, 1827, p. 499 (Ingoda River, Dauria).

A male and a female in somewhat worn breeding plumage were both taken 2 June 1926 in spruce forests in the Dachso canyon, 11,000 feet, eastern Kokonor. Two examples in fresh autumn plumage were taken during September 1926 in the forests of Pezlu, upper Tebbuland.

PHYLLOSCOPUS HUMEI PRAEMIUM (Mathews and Iredale)

Reguloides humei praemium Mathews and Iredale, Austr. Av. Rec. **3**, 1915, p. 45 (nom. nov. pro *Motacilla superciliosa* Gmel. nec Bodd., Russia).

Ten specimens of this puzzling willow warbler were secured; a pair in poplar forest along the Tao River near Choni during May 1925; a pair in the willow forests of the Kwadjaku valley, 10,000 feet, Minshan range, June 1925; a pair at 11,500 feet, in the spruce forests south of the Yellow River opposite Radja 26 May 1926; two males and a female from the spruce forests of the Dachso canyon, 11,000 feet, 2 June 1926, and a female in fresh autumnal plumage from the forests of Wantsang Ku, Ha Tebbuland, 8,500 feet in September 1926.

Stuart Baker (The Fauna of British India, second ed., vol. II, p. 470, Apr. 1924) places *Phylloscopus mandellii* Brooks (1879) in the synonymy of *P. h. praemium*, saying that dark-headed and richly colored birds occur everywhere throughout the ranges of both subspecies. If he is right in considering *mandellii* the same as *praemium*, then the

name must, of course, be *mandellii*. Perhaps, however, Baker means that *mandellii* cannot be surely identified as either one or the other race. We have adopted the latter interpretation of his remarks.

PHYLLOSCOPUS MAGNIROSTRIS Blyth

Phylloscopus magnirostris Blyth, Journ. As. Soc. Bengal, **12**, 1843, p. 966 (Calcutta).

Four males of this species were taken during May or early June near the banks of the Tao River at Choni, where the birds frequented willow scrub; four were secured in eastern Kokonor, a female 26 May 1926 at 11,500 feet in the spruce forests south of the Yellow River and opposite Radja, two males in the spruce and birch forests, 11,000 feet, in the Dachso canyon 2 June 1926, and a female at 11,500 feet in the mountains southwest of the Yellow River opposite Radja, June 1926; during September and October two males and two females were collected at 9,500 feet in the forests of Drakana, upper Tebbuland.

PHYLLOSCOPUS TROCHILOIDES CLAUDIAE (La Touche)

Acanthopneuste trochiloides claudiae La Touche, Bull. B. O. C. **43**, 1922, p. 22 (Mengtsz, Yunnan).

An immature male was taken at 8,000 feet in the forests of Wantsang Ku September 1926.

LANIIDAE

LANIUS BUCEPHALUS SICARIUS subsp. nov.

Type.— No. 239069 Mus. Comp. Zööl., adult female from mountains in the Tao valley near Choni, 9,000 feet. Collected May 1925 by J. F. Rock (orig. No. 84).

Characters.—Somewhat similar to *Lanius b. bucephalus* Temm. and Schl. but crown, nape and auriculars much darker—almost burnt-umber—sharply defined against the dark olivaceous gray of the back, the latter without trace of brownish; tail more slaty; below much more heavily and completely barred, and bars much blacker; bill, entirely black and relatively more slender.

Measurements.—Wing, 82; tail, 89; bill from base of forehead, 18; height of bill at base, 8 mm.

The single example of this form secured by Dr. Rock differs so radically from any specimen in a large series of *bucephalus* from Japan and eastern China that we have no alternative but that of describing it;

the heavy black barring of the underparts, covering even the abdomen, serves to separate our bird at once from even the most heavily barred immature autumnal females of true *bucephalus*, while the dark olivaceous gray of the upper parts and dark brown cap cannot be matched.

LANIUS TEPHRONOTUS (Vigors)

Collurio tephronotus Vigors, P. Z. S., 1831, p. 43 (Himalayas).

This Shrike was found near Choni during May and June 1925, and Rock's notes show that it was common in the willow forest, where two males and a female were secured; 24 May 1926 two adult males were collected at 11,000 feet in the mountains across the Yellow River from Radja; two juvenal males were taken in the forests of Drakana, upper Tebbuland, one at 10,500 feet in August, 1925, the other at 9,500 feet in September 1926.

LANIUS CRISTATUS CRISTATUS Linn.

Lanius cristatus Linn., Syst. Nat. ed. 10, 1, 1758, p. 93 (Bengal).

A single female was taken in June 1925 at an elevation of 9,600 feet in the mountains of Choni. The bird quite probably was a straggler or or belated migrant, since the species is not known to breed in any part of Kansu. A note on the label reads "rare."

PARIDAE

PARUS SONGARUS AFFINIS (Przewalski)

Poecile affinis Przewalski, Mongol i. Strana Tangut, 2, 1876, p. 52 (Ala-shan and Kansu).

Eleven specimens of this willow tit were secured; three males and three females from the region about Choni, May and June 1925, and January 1926; four more examples were collected in eastern Kokonor, a male in spruce forest at 11,000 feet, south of the Yellow River opposite Radja, 26 May 1926, and three males and a female in the Dachso canyon, Yellow River gorges at a like elevation, 2 June 1926.

PARUS SONGARUS WEIGOLDICUS Kleinschmidt

Parus weigoldicus Kleinschmidt, Falco, 1921, p. 3 [*Nom. nov. pro Parus salicarius weigoldi* Kleinsch., Berajah, 1921, p. 19 (Atentze, northern Yunnan) **nec** *Parus cristatus weigoldi* Tratz, Orn. Mon. 1914, p. 50 (Portugal)].

The collection contains four males, two from the forests of Pezlu, two from the forests of Drakana, 7,200 and 9,500 feet respectively, upper Tebbuland, September 1926.

These specimens are easily distinguished from *affinis* by their much deeper coloration, particularly the top of the head and nape which are dull blackish, and the back which is a deeper brownish.

The birds recorded from western Szechuan by Thayer and Bangs (Mem. M. C. Z. 40, no. 4, 1912, p. 183) as *Penthestes affinis* are, of course, referable to *P. s. weigoldicus*.

Many Europeans consider that the Willow Tits of the Old World are so closely related to the American Chickadee, *Parus atricapillus*, that they list them as subspecies of that bird. This procedure does not properly represent the facts. The American forms are quite unlike their Old World cousins in life, and have very different voices, and we unhesitatingly consider them specifically distinct.

PARUS DAVIDI (Berez. and Bianchi)

Poecile Davidi Berezowski and Bianchi, Aves, Exped. Potanini, 1891, p. 113, pl. 2, fig. 4 (southern Kansu).

A male and two females of this species were secured at an elevation of 8,000 feet in the forests of Wantsang Ku, Ha Tebbuland, in September 1926, and a third female was taken there at 8,500 feet.

PARUS SUPERCILIOSUS (Przew.)

Poecile superciliosa Przewalski, Mongol i. Strana Tangut, 2, 1876, p. 54 (alpine regions of the Kansu mountains).

This species apparently occurs sparingly over western Kansu. A female in worn breeding plumage was taken in the poplar groves of the Tao valley in May 1925; another female in still more worn plumage is from 11,000 feet in the Minshan spruce forests of the Tebbu country, August 1925, while a male and a female in fresh autumnal feather were collected in the Babo district of the north Kokonor Barrier range in October 1925.

PARUS DICHROUS DICHROIDES (Przew.)

Lophophanes dichroides Przewalski, Mongol i. Strana Tangut, 2, 1876, p. 54 (lower mountain ranges of Kansu).

Rock collected a series of fourteen examples of this titmouse. A female was taken in the spruce forests of the Tao River valley in January 1926; a juvenal male at 11,000 feet in the forests of the Minshan range in June 1925; a male in the spruce forest at 11,500 feet at the Great Rock Gate of the Minshan range August 1925. In the Tebbu

country the species appeared to be very numerous, ten examples being secured during September 1926 at elevations ranging between 8,000 and 9,500 feet. One of these is a juvenal, but the others have the long crest feathers fully developed. The westernmost locality where a specimen was collected is the Dachso canyon of the Yellow River in eastern Kokonor, where a male was secured at 11,000 feet 2 June 1926.

Some of the birds, regardless of season bear a note on their labels that the eyes are "brown," others that the eyes are "red." Przewalski's original diagnosis reads "iris rubiginosa."

The olive back, present in adults at all seasons, as well as in the immature, serves to distinguish this race at once from any of the other forms of the species.

Three specimens of the bird from the isolated Washan Mountain, where it is restricted to the upper coniferous slopes, belong to a separable form, as Kleinschmidt and Weigold have already pointed out (Abh. u. ber. Zööl. Mus. Dresden, **15**, 1922, no. 3, p. 13). This race we name

PARUS DICHROUS ARCEUTHINUS subsp. nov.

Type.—No. 50822 Museum of Comparative Zoölogy, collected on Washan Mountain (11,000 feet), western Szechuan, 4 June 1908, by W. R. Zappey.

Characters.—Similar to *P. d. dichroides* but much paler, more ashy gray above, the back nearly concolorous with the head; much paler fawn color below. Similar also to *P. d. wellsi* Stuart Baker, but much paler in color throughout.

PARUS RUFONUCHALIS BEAVANI (Jerd.)

Lophophanes beavani Jerdon, Bds. India, **2**, 1863, p. 275 (Mt. Teringloo, Sikkim).

But four specimens of the Sikkim Black Tit were collected, all of them from the country south of the Minshan range. A male from the southern slopes of the Minshans at 9,800 feet in June 1925, a female in August 1925 in the Kadjaku valley at 9,500 feet, a male from the forests of Drakana, 9,500 feet, upper Tebbuland, September 1926, and a male from the forests of Wantsang Ku, 8,500 feet, September 1926.

PARUS VENUSTULUS Swinhoe

Parus venustulus Swinhoe, P. Z. S., 1870, p. 133 (Yangtse gorges, Hupeh).

Four of these birds were taken in the willow groves in the Tao valley near Choni, during May 1925, a fifth specimen was taken at

10,000 feet in the mountains of Choni, south of the Tao River, June 1925. An immature female was secured in the forests of Wantsang Ku, lower Tebbuland, 8,500 feet, September 1926.

PARUS MONTICOLUS MONTICOLUS Vigors

Parus monticolus Vigors, P. Z. S., 1831, p. 22 (Himalaya).

But one specimen of the green-backed tit was secured — a male from the forests of Wantsang Ku, 8,500 feet, September 1926.

This specimen, judging by our inadequate topotypical material, belongs to the nominate form, in any event it is not referable to *P. m. yunnanensis* La Touche, a slightly differentiated race, characterized by the rather brighter greenish yellow of the mantle and brighter yellow sides, points which are hardly appreciable except when the birds are viewed in series.

PARUS MAJOR TIBETANUS Hart.

Parus major tibetanus Hartert, Vög. Pal. Faun. **1**, heft 3, 1905, p. 346 (Chaksam, Tsing Po valley, Tibet).

Rock secured ten specimens of the great tit as follows: an adult female in very worn breeding plumage from scrub beside the Minchow road, 5,000 feet in southern Kansu, May 1925; an adult female from the scrub forest in the Tao valley at Choni, May 1925; a male and two females from the Choni spruce forests, January 1926. Three males and two females were collected in the forests of Wantsang Ku and Mayaku in upper Tebbuland 8,000 to 8,500 feet, in September 1926.

We can detect no differences in these series from north and south of the Minshan range. Furthermore there are no constant characters that we can detect by which to separate the great tits of northwestern Yunnan, western Szechuan and southwestern Kansu; in our opinion they all belong to the same form, characterized by large size and a good deal of white in the second tail feather. The latter character is variable, altogether too variable a criterion on which to base any further subdivision within the above area, and we do not recognize *P. m. subtibetanus* (Kleinsch. and Weig., Abh. u. ber. Mus. Dresden, **15**, 1922, no. 3, p. 11, Tatsienlu, Szechuan).

AEGITHALISCUS FULIGINOSUS FULIGINOSUS (J. Verr.)

Mecistura fuliginosa J. Verreaux, Nouv. Arch. Mus. Paris, Bull. **5**, 1869, p. 36 (eastern Tibet = western Szechuan).

Three males were taken during September 1926, one of them at 7,200 feet in the forests of Pezlu, upper Tebbuland, the others at 8,000

feet in the forests of Wantsang Ku, lower Tebbuland. The first mentioned specimen had the irides "yellow," one of the others "yellowish brown." None of these birds had completed the autumnal moult.

Verreaux's description of this species is too generalized to be of any use in determining subspecies, and the plate published (Nouv. Arch. Mus. Paris, Bull. 8, 1872, pl. 5), on which this bird is figured (fig. 4) with three other species, is not accurately colored. We must therefore assume our birds to be like those from western Szechuan and refer birds from Hupeh to a new race.

AEGITHALISCUS FULIGINOSUS SCURRULA subsp. nov.

Type: No. 50968 Mus. Comp. Zoöl. from Hsien Shan Hsien, Hupeh, collected 25 December, 1907 by Walter R. Zappey.

Characters.—Similar to *A. f. fuliginosus*, but the brown parts of the plumage much paler, about "Mummy Brown" of Ridgway. In *A. f. fuliginosus* the brown parts are very dark, between light seal brown and black. This difference is very conspicuous in the color of the breast band. Measurements: wing, male 56–60; female 56–57; tail, male 52–58; female 51–52. (9 males and 2 females.)

AEGITHALOS GLAUCOGULARIS VINACEA (J. Verr.)

Mecistura vinacea J. Verreaux, Nouv. Arch. Mus. Paris, Bull. 6, 1870, p. 39 (mountains of Chinese Tibet).

The northern Silver-throated Tit was common about Choni; a pair of adults in extremely worn plumage was taken in the forests there, at 9,600 feet in June 1925; during January and February 1926 the species frequented the willow scrub in the Tao River valley, where seven examples were secured. A much abraded male was shot on 23 June 1926 on the banks of the Ba River 9,900 feet, south of the Jupar range in eastern Kokonor. A male and two females were collected in September 1926 along the valley of Chulungapu in the juniper forests of Pezlu, upper Tebbuland, while lower Tebbuland is represented by a male taken in the forests of Mayaku, 8,500 feet, September 1926.

CEPHALOPYRUS FLAMMICEPS OLIVACEUS Roths.

Cephalopyrus flammiceps olivaceus Rothschild, Nov. Zoöl. 30, 1923, p. 263 (Tengyueh, northwestern Yunnan).

A single female of this strongly marked form was secured in April 1925 at 5,000 feet altitude in mixed forest on the mountains of northern Szechuan near Chingchuan.

REGULIDAE

REGULUS REGULUS COATSI Sushk.

Regulus cristatus coatsi Sushkin, Bull. B. O. C. **14**, 1904, p. 44 (subalpine zone of Sayan range).

Rock collected five Kinglets during the autumn of 1925. Two males were taken in October in willow scrub in a stream bed at Babo 9,500 feet between the Kokonor Barrier and the Richthofen ranges; in November two males and a female were secured in a similar situation at 7,000 feet elevation in the Liyuan gorge on the northern slopes of the Richthofen range.

These specimens all differ from *R. r. japonensis* Blakist. in being less washed with gray on the nape and sides of the head, in this particular agreeing with the original description of *coatsi*; they do not, however, confirm the difference in size between this race and *japonensis* as claimed by Buturlin (Mess. Orn. 1916, p. 100).

Western Kansu is some distance south of the region which *coatsi* inhabits, but the lateness of the season makes it reasonable to suppose that our birds are migrants from further north.

LEPTOPOECILE SOPHIAE DESERTICOLA Hartert

Leptopoecile sophiae deserticola Hartert, Vög. Pal. Faun. **1**, heft 4, 1907, p. 401 (Kara-Sai, eastern Turkestan).

Five specimens of this excellent race were collected in the Kokonor Barrier ranges; a male at 13,000 feet near a summit in the southeast Barrier range September 1925; three males and a female in spruce forest at 10,000 feet on Mt. Nginsin, north Barrier range in October 1925.

A collector's note on the labels of two of the males states that the eyes are "red."

LEPTOPOECILE SOPHIAE OBSCURA Przew.

Leptopoecile obscura Przewalski, Zapisk. Imp. Ak. Nauk St. Petersb. **55**, 1887, p. 80 (mountain forests of northeastern Tibet.)

During January 1926 four males and two females were secured in willow scrub or in the willow and poplar forests in the Tao River valley near Choni.

LOPHOBASILEUS ELEGANS (Przew.)

Leptopoecile elegans Przewalski, Zapisk. Imp. Ak. Nauk St. Petersburg. 55, 1887, p. 77 (upper Yellow River and temple of Tschertyngon).

In eastern Kokonor this species was secured in rhododendron scrub at 11,000 feet in the Rako gorge, September 1925 and in willow bushes south of the Yellow River opposite Radja 26 May 1926, in both cases a single male collected. An adult female was taken in October 1925 at 10,000 feet altitude in spruce forest, Babo district, north Kokonor Barrier range. During September 1926 three males and a female were shot in the forests of Drakana, upper Tebbuland, between 9,000 and 9,500 feet; two of the males are juvenals, but with "red" irides, as in the adults.

SITTIDAE

SITTA EUROPEA SINENSIS Verreaux

Sitta sinensis Verreaux, Nouv. Arch. Mus. Paris, Bull. 6, 1870, p. 34 (mountains of Chinese Tibet, error!).

Rock collected three male examples of this nuthatch in the forests of Mayaku and Wantsang Ku, lower Tebbu country in September 1926; all three have completed the moult and are in fresh autumnal plumage. These birds average a little larger than birds from either Fokien or Hupeh, wing 77, 78, 80, but in other respects they are identical with *sinensis*.

As Hartert has shown, Verreaux based this form on three specimens, a male from Kiukiang, northern Kiangsi, and a pair from Moupin, Szechuan, but the two latter belong to the race now known as *montium* La Touche, so that Hartert fixed the name on the Kiukiang bird (Vög. Pal. Faun. 1, p. 333). La Touche (Handb. Bds. east. China, pt. 1, July 1925, p. 38) considers the Fokien bird to be *sinensis* and endeavors to uphold *itschangensis* Kleinschm. and Weig. as a valid race. With a large series before us, we can see no differences whatever between Hupeh and Fokien specimens. In any event the Hupeh birds must be called *sinensis* (not being preoccupied by *chinensis*) with the type locality fixed as Kiukiang, just south of the Hupeh border, and if there was any race to be named, it would be the Fokien bird.

SITTA LEUCOPSIS PRZEWALSKII Berez. and Bianchi

Sitta Przewalskii Berezowski and Bianchi, Av. Exp. Potanini 1891, p. 119, (upper Chuangue).

A male of the white-checked nuthatch was collected in the spruce forests of Choni in February 1926; three more examples (two males

and a female) were taken in the forests of Drakana at 9,500 feet, and a male at 8,500 feet in the forests of Wantsang Ku in September 1926.

SITTA CANADENSIS VILLOSA Verreaux

Sitta villosa Verreaux, Nouv. Arch. Mus. Paris, Bull. 1, 1865, p. 78, pl. 5, f. 1 (north of Pekin).

Three of this little nuthatch were collected; a male and a female at 7,000 feet in the Liyuanku gorge, northern slopes of the Richthofen range, and a female in the spruce forests of the north Kokonor Barrier range, all in October 1925.

It is difficult to distinguish some skins of *villosa* from some of *canadensis*. Usually however, the former is larger and paler, and has the black portion of the auriculars always flecked with whitish; *canadensis* normally has the same region solid black, but occasionally a specimen is found flecked with white as in *villosa*.

CERTHIIDAE

CERTHIA FAMILIARIS TIANSHANICA Hartert

Certhia familiaris tianschanica Hartert, Vög. Pal. Faun. 1, heft 3, 1905, p. 321. (Ak-su (River?), southern Tian Shan).

A male taken 31 May 1926 in juniper forest at 11,000 feet in the Howa valley, Yellow River gorges north of Radja, agrees with the original diagnosis of this pale form, except that the dusky spot on the under wing-coverts is not very distinct, thus approaching *f. familiaris*; however, it is a large bird (wing 69 mm.), and for this reason we refer it to *tianschanica*.

There is still much work to be done in clearing up the breeding ranges of the tree creepers in western China.

CERTHIA FAMILIARIS BIANCHII Hartert

Certhia familiaris bianchii Hartert, Vög. Pal. Faun. 1, heft 3, 1905, p. 321 (southern Tetung Mountains, Kansu).

There are five specimens in the collection characterized by dark upper parts, rusty spot on the outer web of the fourth primary and by rusty or fawn-colored abdomen and under tail coverts; in these details they agree with Hartert's description of *bianchii*. One of them is a female shot near Choni in February 1926; the other four are males collected in the forests of Drakana, 9,500 feet during September 1926.

Lönnberg (Ibis, 1922, p. 312) records *Certhia f. khamensis* Bianchi from the Minshans, but our examples from upper Tebbuland are not referable to that race.

CERTHIA FAMILIARIS KWANHSIENSIS Kleinsch. & Weig.

Certhia familiaris kwanhsienensis Kleinschmidt and Wiegold, Abh. u. ber. Zoöl. Mus. Dresden, **15**, No. 3, 1922, p. 7 (Kwanhsien, Szechuan).

The single specimen from Ha Tebbuland, a male from the forests of Sambaku, 9,000 feet, taken in September 1926, lacks the rusty spot on the outer web of the fourth primary and has a distinctly gray wash over the abdomen; these characters force us to place the bird in the form recently described by Kleinschmidt and Wiegold.

The bird recorded by Thayer and Bangs as *Certhia familiaris khamensis* (Mem. M. C. Z. **40**, no. 4, 1912, p. 186) from Lianghow Kow, western Szechuan, is referable here.

It seems to us that the length of the bill in *Certhia familiaris* is too subject to individual variation to serve as a really reliable diagnostic character.

CERTHIA HIMALAYANA YUNNANENSIS Sharpe

Certhia yunnanensis Sharpe, Bull. B. O. C. **13**, 1902, p. 11 ("Shayang, Chutung Road").

Four examples of this bird were secured: — a male in the gorges of the Wutu River in May 1925, a male in the Taochow valley, 31 May 1925, a female near Choni in February 1926, and a male in the forests of Drakana, 9,500 feet September 1926.

These four specimens are all alike and agree with Sharpe's original description of *yunnanensis*, but lacking topotypical material of that form we sent one of our specimens to Mr. N. B. Kinnear at the British Museum (Natural History) who writes "the tree creeper agrees in every way as far as I can see with *C. h. yunnanensis*."

TICHODROMA MURARIA (Linn.)

Certhia muraria Linné, Syst. Nat. ed. 12, **1**, 1766, p. 184 (southern Europe).

Four specimens of the Wall Creeper were taken. A male at Peshingai, 10,600 feet, southwestern Kansu, 30 May 1925; a male on the rocky banks of the Tao River below Choni in March 1926; a female 20 May 1926 along the Yellow River near Radja, and a male at the mouth of the Deyang valley, 10,000 feet, near Radja, June 1926. The May specimens are in the process of acquiring the black throat, which the June bird has completely assumed.

MOTACILLIDAE

MOTACILLA ALBA LEUCOPSIS Gould

Motacilla leucopsis Gould, P. Z. S., 1837, p. 78 (India).

The White-faced Wagtail is represented by three males: an adult taken along the Tao River near Choni in June 1925, another adult from the Yellow River near Radja 20 May 1926, and an immature male taken in September 1926 at an elevation of 10,700 feet on the south shore of Lake Kokonor.

BUDYTES CITREOLA CITREOLA (Pallas)

Motacilla citreola Pallas, Reis. Versch. Prov. Russ. Reich, 3, 1776, p. 696 (eastern Siberia).

Neither of the two examples of Yellow-headed Wagtails sent in by Rock is *B. c. citreoloides*, the breeding bird of the region. Undoubtedly both were migrants belonging to the form of more northerly breeding range. A male in the plumage of the first spring was secured in May 1925 near Choni, and an immature female was taken along a water course near Wantsang Ku, Ha Tebbuland, in September 1926.

ANTHUS HODGSONI Richmond

Anthus hodgsoni Richmond, Carn. Inst. Wash. publ. no. 54, 1, pt. 2, 1907, p. 493 [*Nom. nov. pro Anthus maculatus* Hodgs. (Nepal), *nec Motacilla maculata* Gmel. = *Anthus campestris* (Linn.)].

During June and July 1925 this species was met with in alpine meadows on the summits of the Minshan range at elevations ranging between 11,500 and 13,000 feet, where three males and two females in somewhat worn summer dress were secured. A male taken in May along the rocky gorges of the Minchow River in southern Kansu, 5,000 feet altitude is also abraded. In September 1926 two additional examples were collected in the forests of Ha Tebbuland: a female with the first immature plumage not yet complete, and an adult female in an advanced state of moult.

We have examined very large numbers of specimens of *A. hodgsoni* from many different regions, and are wholly unable to recognize either *A. h. yunnanensis* Uchida and Kuroda or *A. h. berezowskii* Sarudny. Every series, if long, presents rather striking differences due entirely to season, age, wear or individual variation, but we fail to find any real characters by which the species can be subdivided.

ANTHUS RICHARDI RICHARDI Vieillot

Anthus Richardi Vieillot, Nouv. Diet. Hist. Nat. **26**, 1818, p. 491 (France).

Rock secured a male and two females of Richard's Pipit near Taochow in the Tibetan grasslands of southwestern Kansu, elevation 10,000 feet, in May 1925; a third female was taken in June of the same year on the alpine meadows of the Choni mountains.

One of the Taochow examples has a hind toe only as long as the hallux, one of the criteria for the determination of *A. r. striolatus*, but in the other two specimens from the same place, the hind claw is very long and the tip attenuated. This often seems to be the case among the species of pipits with long hind claws; they become worn very thin distally, and the tips eventually break off.

ANTHUS ROSEATUS Blyth

Anthus roseatus Blyth, Journ. As. Soc. Bengal, **16**, 1847, p. 437 (Nepal).

A. roseatus is the common pipit of the region, as evidenced by a series of fifteen specimens. During the breeding season Rock found the bird in alpine meadows on grassy mountain summits of the Minshan range between 11,500 and 13,000 feet, and in similar situations in the mountains of eastern Kokonor. In September 1925 one was secured in grasslands along the southwestern shore of Lake Kokonor. In November 1925 one was secured at the summit of a pass (9,600 feet) in the Richthofen range.

ANTHUS SPINOLETTA BLAKISTONI Swinhoe

Anthus blakistoni Swinhoe, P. Z. S., 1863, p. 90 (Yangtze River, 140 miles inland).

The Chinese water pipit was met with only in eastern Kokonor. A male was secured in the Dzomo valley, north of Dzomola, at an altitude of 11,300 feet on 21 June 1926, and another male, 26 June, at an elevation of 13,100 on the northern slopes of the Jupar range. The former bird was taken in willow scrub near a river bank; the latter in an alpine meadow. The plumage of both specimens is much worn.

ALAUDIDAE

EREMOPHILA ALPESTRIS NIGRIFRONS (Przewalski)

Otocoris nigrifrons Przewalski, Mongol i. Strana Tangut, **2**, 1876, p. 103 (Kansu, Kokonor, Zaidam and northern Tibet).

Twenty-two specimens of horned larks were taken, that, in spite of seasonal differences in plumage, are clearly referable to only one

subspecies. Five males and a female were collected on Tibetan grasslands between Taochow and Choni at an elevation of between 9,000 and 10,000 feet during May. On the Ba plains, 10,500 feet, two males and two females in worn breeding plumage were collected on June 24, 1926, and a three-quarters grown juvenal on June 22. During September 1925 seven specimens of both sexes were taken on the grasslands about Lake Kokonor. Four of these are apparently birds of the year in fresh immature plumage, a fifth still retains a number of feathers of the juvenal plumage on the head, while yet another is a fully grown juvenal, and the last an adult female at the height of the autumnal moult. In November 1925 three males and a female were secured at an elevation of 10,500 feet on the grasslands of Obo, north Kokonor Barrier range.

Although Hartert has placed *Otocoris nigrifrons* in the synonymy of *elwesi*, we are convinced that it is a valid race and occupies essentially the area assigned to it by its describer. Since Przewalski did not designate a definite type locality we suggest as such the grasslands about Lake Kokonor.

E. a. nigrifrons is readily distinguishable from *E. a. elwesi* by darker coloration above and by its smaller size (male, wing 109-115 mm. as against 115-125 in *elwesi*). From *khamensis*, *nigrifrons* is distinguished by its much smaller size, narrower black frontal band and shorter bill. The range of *E. a. brandti* probable adjoins that of *nigrifrons* on the north, but the former race may be readily distinguished by its much more sandy coloration above and lack of black frontal band (the black being restricted to the tuft of plumes over the nostrils), although the two forms are of about the same size.

ALAUDA ARVENSIS INOPINATA Bianchi

Alauda japonica inopinata Bianchi, Ann. Mus. Zoöl. St. Petersb. **9**, 1905, p. 31 (eastern Tibet, Nan Shan, Kokonor, upper Mekong, upper Brahmaputra, Gyantze, Lhasa).

The only Skylark in the collection, a male, was taken on 4 June 1926, at an elevation of 13,700 feet, on the Waro Pass, north of Radja.

GALERIDA CRISTATA RETRUSA subsp. nov.

Type.—No. 238709 Mus. Comp. Zoöl., adult male from the Kanchow plain, foot of the northern Kanchow Nanshan, collected November 1925 by Joseph F. Rock (orig. no. 470).

Characters.— Similar to *Galerida cristata magna* Hume but smaller; more grayish, less brownish above with the central portions of the feathers darker; below more nearly white, less washed with rusty yellow.

Measurements

<i>Number</i>	<i>Sex</i>	<i>Wing</i>	<i>Tail</i>	<i>Tarsus</i>	<i>Bill from base</i>
238709	♂	102	58	24	17
238710	♀	106	62	24.5	18

In addition to the type a second specimen, a female, was collected at the same time and place.

Dr. Herbert C. Robinson very kindly examined these specimens for us at the British Museum, and writes that they agree most nearly in color and other particulars with *Galerida cristata ivanowi* Louden, but that they are much too small for that form. They scarcely need comparison with the smaller and much redder *leautungensis* (Swinh.) to which they come nearest geographically.

MELANOCORYPHA MAXIMA Gould

Melanocorypha maxima Gould, Bds. Asia, 4, 1867, pl. 72 and text (type locality as substituted by Hartert, "Border of Sikkim," Vög. Pal. Faun. 1, heft 2, 1904, p. 211).

Four of these very large larks were collected September 1925 in the grassy country bordering the southern shore of Lake Kokonor. Two more, a male and a female were secured on grasslands at an elevation of 11,400 feet in Tsechu drainage, eastern Kokonor on 11 May 1926. Rock made a note on the label of one of the specimens that reads:—"These birds fly very low and can be hit with a stick."

MELANOCORYPHA MONGOLICA (Pallas)

Alauda mongolica Pallas, Reis. Versch. Prov. Russ. Reick, 3, 1776, p. 697 (between "Ononem et Agrunum.")

The single specimen of this species in the collection, is a male taken in the grasslands on the southern shore of Lake Kokonor September 1925. The bird, an adult, was moulting heavily and acquiring a new tail all at once, all the old feathers having been shed.

FRINGILLIDAE

CHLORIS SINICA SINICA (Linn.)

Fringilla sinica Linné, Syst. Nat. ed. 12, **1**, 1766, p. 321 (China).

The Chinese Green Finch apparently is not numerous in this region. A male was secured near Minchow, 5,000 feet, in southern Kansu and five of both sexes in the vicinity of Choni and Taochow between 8,500 and 9,000 feet, all in poplars along streams, or in open situations. An immature male was collected at Babo, northern slope of the Kokonor Barrier range in spruce forest.

All of these specimens agree with birds from Szechuan and Hupeh, which we believe to represent typical *sinica*.

PERISSOSPIZA CARNIPES CARNIPES (Hodgs.)

Coccothraustes carnipis Hodgson, As. Res. **19**, 1836, p. 151 (Nepal).

Twenty-two specimens of the White-winged Grosbeak were taken in the Tao valley, the Minshan range, the basin of the Yellow River in eastern Kokonor and the forests of Drakana in upper Tebbuland. In all cases the birds were found in spruce or in juniper forest. No examples were collected below 9,500 feet. A note by Rock on the label of a bird taken May 31, 1926, in the Howa gorge, 11,000 feet, eastern Kokonor, states that the species was then feeding on the hard juniper berries.

PERISSOSPIZA ICTEROIDES AFFINIS (Blyth)

Hesperiphona affinis Blyth, Journ. As. Soc. Bengal, **24**, 1855, p. 179 (alpine Punjab).

One adult male of this species was taken at an elevation of 10,000 feet in the spruce and fir forests of Sambaku, Ha Tebbuland, September 1926. The specimen was in an advanced state of the autumnal moult.

FRINGILLA MONTIFRINGILLA Linn.

Fringilla montifringilla Linné, Syst. Nat. ed. 10, **1**, 1758, p. 179 (Sweden, *apud* Hartert).

Rock secured one female Brambling at the edge of the forest near Choni, May 1925.

ACANTHIS FLAVIROSTRIS subsp.

We are at a loss to place the subspecies of the single Twite in the collection. It is sexed as a male. It is in fresh immature plumage and lacks the pink rump. The bird was taken at Hung Shui Ku, eastern end of the Kanchow Nanshan, 8,000 feet, October 1925.

The specimen is too pale for *miniakensis* which is represented in the Museum of Comparative Zoölogy by an adult male cotype collected by Weigold at Bameh, Szechuan, 11 November 1915. It seems to be in color more nearly like *montanella* Hume or *altaica* Sushkin, but is small for either (wing 73).

LEUCOSTICTE NEMORICOLA NEMORICOLA (Hodgson)

Fringalauda nemoricola Hodgs., As. Res. 19, 1836, p. 158 (central and north regions of Nepal).

Rock took ten specimens of this species, which he found on the summit of Mt. Koanzku of the Minshan range at 13,000 feet in June 1925; in alpine meadows, 12,500 feet during July and August 1925 in Tebbu-land; at 12,500 feet below Kerab pass in the Jupar range, 24 June 1926, and as low as 11,300 feet on rocky cliffs in the Dzomo valley, north of Dzomola, 21 June 1926.

We retain this species in the genus *Leucosticte*, because we do not believe that the genus *Fringalauda* (type *F. nemoricola* Hodgs.) is sufficiently distinct. Most of the species of *Leucosticte*, it is true, have a dense tuft of short incurved feathers completely covering the nostrils, rather stout feet and a somewhat conical bill, while *nemoricola* is aberrant in having the nasal tufts less developed, more slender feet, and more elongate bill. The bird that Hartert described, however, as *Montifringilla brandti walteri* (Vög. Pal. Faun. 1, 1904, p. 138) is in our opinion a distinct species that bridges the differences between *Leucosticte* and *Fringalauda* and should stand as *Leucosticte walteri* (Hart.).

ERYTHRINA ERYTHRINA ROSEATA (Hodgs.)

Pyrrhuloxia roseata Hodgs., P. Z. S., 1845, p. 36 (Nepal and Hindustan).

This bird is represented in the collection by eighteen skins. Eight adult males and three females were secured near Choni during May and June 1925, at elevations ranging from 8,500 to 9,500 feet, taken in willow and poplar bushes along the Tao River, and at the borders of the spruce forests in the mountains of Choni. From the Tebbu country

we have one adult and one immature male and five females taken between the altitudes of 7,200 and 9,500 feet in bushes along streams and in alpine meadows at 12,900 feet.

All the adult males in the series are very deep and richly colored, slightly darker even than birds taken by Zappey in Szechuan at the corresponding seasons.

ERYTHRINA RUBICILLOIDES RUBICILLOIDES (Przew.)

Carpodacus rubicilloides Przewalski, Mongol i. Strana Tangut, **2**, 1876, p. 90. pl. 12 (mountains of Kansu).

Rock sent in three examples of this rare rose finch; an adult male and a female collected at 7,000 feet, November 1925 at Liyunku on the northern slopes of the Richthofen range and another female from the Tao River valley, 9,000 feet, February 1926.

ERYTHRINA THURA DUBIA (Przew.)

Carpodacus dubius Przewalski, Mongol i. Strana Tangut, **2**, 1876, p. 92, pl. 13. (wooded hills in Ala-Shan and Kansu).

Rock sent in a series of twenty-four specimens of this form from the following places, the region about Choni, the Minshan range, the Yellow River gorges in eastern Kokonor, the valley of the Ba River and the forests of Mayaku, Ha Tebbuland. The species was met with in willows and in spruce forests at elevations between 8,000 and 11,500 feet.

ERYTHRINA DAVIDIANA (Milne-Edw.)

Carpodacus Davidianus Milne-Edwards, Nouv. Arch. Mus. Paris, Bull. **1**, 1865, p. 18-19, pl. 2, f. 2, ♂ (no type locality specified, but probably in the mountains of Shensi or southern Mongolia).

This appears to be a widespread species in southwestern Kansu and adjacent parts of Kokonor. Seven adult males and eight immature males or females were taken at the following localities: Minshan range, summit of Mt. Koang Kei 13,000 feet; Mt. Lieuhoashan 10,000 ft.; Rako gorge 10,500 feet; Tao River basin, Choni 8,500 feet; Yellow River opposite Radja, Dachso canyon; mountains north of Dzomola 12,800 feet; north slopes of the Jupar range, 13,100 feet; and the forests of Ha and upper Tebbuland between 8,500 and 10,000 feet. Most of the specimens were taken in spruce forest, but the species was also found in river gorges among birches and scrub and in alpine meadows.

All recent authors have confused *dauidiana* with *E. pulcherrima* (Hodgs.). Hartert (Vög. Pal. Faun. 1, p. 103) considers the two identical; Thayer and Bangs had specimens of both species from western Szechuan, but did not comment, and called them all *pulcherrimus*. Jacobi (Abh. Ber. Mus. Tierk u. Volkerk Dresden, 16, 1922, no. 1, p. 26-27) also appears to have combined the two species. Rothschild considers *dauidiana* "barely separable" as a subspecies of *pulcherrima*, while Stuart Baker follows the same course, but we suspect that his *pulcherrima* is *waltoni* and his *dauidiana* is *pulcherrima*.

The males in Rock's series agree with the Milne-Edward's original description and plate, but apparently David and Oustalet (Oiseaux de la Chine, 1877, p. 354, pl. 95) described and figured *pulcherrima* under the name of *dauidiana*.

In reality *dauidiana* is a distinct species. It differs from *pulcherrima* in the following characters: larger size, proportionately longer wing-tip; in color it is paler and grayer, less brownish and with dark streaks above blacker; supercilium, sides of head and under parts much paler rose color with a strong silvery appearance; throat and chest with black shaft stripes, middle of abdomen white. Zappey took both species together in the breeding season at Cheto and at Yachiakun in western Szechuan.

Eight males of *pulcherrima* from western Szechuan have wings ranging from 71-79, two females, wing 70. In five males of *dauidiana* from western Szechuan the wing is 83-85, one female 82. Six adult males of *dauidiana* from southwest Kansu and eastern Kokonor, afford a wing length of 82-83; the adult females 81-85.

ERYTHRINA VINACEA VINACEA (Verr.)

Carpodacus vinaeeus Verreaux, Nouv. Arch. Mus. Paris, Bull. 6, 1870, p. 39 (mountains of Chinese Tibet).

One adult male from the forests of Wantung Ku, 8,500 feet, Ha Tebbuland, September 1926.

This bird was in badly worn plumage and was at the start of the autumn moult.

ERYTHRINA TRIFASCIATA (Verr.)

Carpodacus trifasciatus Verreaux, Nouv. Arch. Mus., Paris, Bull. 6, 1870, p. 39 (mountains of Chinese Tibet).

Rock secured two specimens of this rose finch in September 1926; an adult male at an elevation between 9,600 and 10,000 feet in the forests

of Drakana, upper Tebbuland, the other in the Wantsang forests, Ha Tebbuland at 8,500 feet. The latter was part way through the post-juvenal moult and acquiring a plumage in which the red of the old adult male is replaced by ochraceous.

PYRRHULA ERYTHACA TAIPAISHANENSIS Roths.

Pyrrhula erythaca taipaishanensis Rothschild, Nov. Zoöl. **28**, 1921, p. 63 (Mt. Taipaishan, Tsinling range).

Fifteen specimens of both sexes were taken in the mountains and along the Tao River valley near Choni, and between 8,000 and 10,000 feet in the forests of Ha and upper Tebbuland. Birds were taken both in spruce forest in the mountains and in willow brush along the river.

UROCYNCHRAMUS PYLZOWI Przew.

Urocynchramus pylzowi Przewalski, Mongol. i. Strana Tangut, **2**, 1876, p. 99, pl. 15 (sources of the Tetung and alpine regions of the mountains north of the Tetung).

Four examples, two adult males and two adult females of this little-known finch (if a bird with ten primaries can be called a finch) were secured the same day in June 1926 in willow and rhododendron scrub at an elevation of 14,000 feet north of the Dzomola in eastern Kokonor.

The plumage of these specimens is but little abraded, yet the whitish edges of the feathers on the lower parts of the male, so conspicuous in winter plumage, have worn off completely, greatly intensifying the rose color.

There appears to be no more known about this bird than there was when it was first discovered. Accounts of its notes, habits and appearance are still quoted from the original account by Przewalski.

EMBERIZA SPODOCEPHALA MELANOPS Blyth

Emberiza melanops Blyth, Journ. As. Soc. Bengal, **14**, 1845, p. 554 (Tipperah).

Four examples of this bunting were secured near Choni during May and June 1925. Rock met with the species there in forests, mountain meadows and along streams.

EMBERIZA GODLEWSKII NANSHANICA Sushk.

Emberiza godlewskii nanshanica Sushkin, Proc. Boston Soc. Nat. Hist. **38**, no. 1, 1925, p. 24. (Churmyk River, basin of the upper Hwang-ho).

Rock sent in eleven skins of this meadow bunting, breeding and winter birds, as follows: one from Chingchuan, 6,500 feet, northern

Szechuan, April 1925; two from Choni in May 1925 where the birds were then found in poplar forest, or poplar trees along the Tao River. During January and February 1926 four more birds were taken in the Choni forests along the Tao River valley between 8,500 and 9,000 feet elevation. Two females were secured near Radja 10,000 feet, in the Yellow River valley, eastern Kokonor 20 May 1926. A juvenal female was collected in the forests of Pezlu, 12,000 feet, Ha Tebbuland, September 1926.

Sushkin in 1925 (Proc. Bost. Soc. Nat. Hist. **38**, no. 1) recognized seven races of *E. godlewskii* of which four, *nanshanica*, *decolorata*, *khamensis* and *bangsi*, were described as new. For comparison we have *godlewskii*, *omissa*, *khamensis*, *bangsi* and *yunnanensis*, a fair series of each, whose value is much enhanced by reason of having been identified by Sushkin himself. The eleven skins collected by Rock fit into a uniform series, and agree with Sushkin's description of *nanshanica*, besides occurring within the limits assigned to its author. The six races of *E. godlewskii* that we have seen are very close to one another, and can be told apart only in adequate series.

PLOCEIDAE

MONTIFRINGILLA NIVALIS ADAMSI Adams

Montifringilla adamsi Adams, P. Z. S., 1858, p. 482 (Ladakh).

But three examples of this Snow Finch were secured, all in eastern Kokonor: a male in the Dzomo valley, north of Dzomola 12,000 feet, 21 June 1926, and a male and a female on the Ba plain, south of the Jupar range, at 10,500 feet, 22 and 24 June respectively.

The plumage of all these specimens is badly worn and abraded.

PASSER MONTANUS OBSCURATUS Jacobi

Passer montanus obscuratus Jacobi, Abh. u. ber. Mus. Dresden, **16**, 1923, no. 1, p. 32 (Hupeh and Szechuan).

One adult male, Ba valley, eastern Kokonor, 9,000 feet, in willow bushes along stream. 23 June 1926.

With a series of thirty specimens from the Yangtze valley in Hupeh we are unable to confirm the color characters attributed to this form by its original describer, neither is it as small as is claimed in the original description. Tree Sparrows from Central China, however, appear to average stouter billed than *P. m. montanus*, although this organ is not

as heavy as it is in *saturatus*; *obscuratus* is thus an intermediate form. Stuart Baker (Bull. B. O. C. **45**, 1925, p. 92) described *Passer montanus tibetanus* as differing in having a redder rump and much larger size (wing 76–82), but in volume 3 of his Birds of British India (1926, p. 179), he refers to *obscuratus* all Tree Sparrows from Tibet and Sikkin to Szechuan, apparently abandoning his *tibetanus*. Our series from the Yangtze valley varies in wing measurement from 65 to 74 and the one Kokonor example has a wing of 75.

PASSER RUTILANS RUTILANS (Temm.)

Fringilla rutilans Temminck, Pl. Col. **3**, 1829, p. 488 (Japan).

Rock sent a male from the mountains of northern Szechuan and a female taken in the spruce forest on the mountains of Choni at an elevation of 9,000 feet in May 1925.

STURNIDAE

SPODIOPSAR CINERACEUS (Temminck)

Sturnus cineraceus Temminck, Pl. Col., 1832, pl. 556 (Japan).

Seven specimens of both sexes were secured; five in the gorges of the Heu Hsien River near Pikow in extreme southern Kansu during May 1925, and two more in willow forests along the Tao River near Choni in June of the same year.

CORVIDAE

CORVUS CORAX TIBETANUS Hodgson

Corvus tibetanus Hodgson, Ann. & Mag. Nat. Hist. (2), **3**, 1849, p. 203 (Tibet).

Only one skin of a Raven was sent in. The bird, a female, was taken near Lake Kokonor, 10,700 feet elevation, in September 1925. A note on the label reads "grass country and desert sands, in flocks." Wing, 479.

Although we have not gone as thoroughly into the question of geographic variation in the Ravens as Meinertzhagen has, nevertheless we rather agree with him (Nov. Zoöl. **33**, 1926, p. 98) that the large circumpolar Ravens should all be united under one name. Meinertzhagen did not quite have the courage of his convictions, and did not finally dispose of *Corvus corax varius*, the Faroe Islands Raven, which is an older name than *tibetanus*. Thus the status of the Faroe Island bird

being still uncertain, we use *tibetanus* as a name of undoubted application for our specimen.

CORVUS DAURICUS DAURICUS Pallas

Corvus dauricus Pallas, Reise Russ. Reich. **3**, Anhang 1776, p. 694 (region of Lake Baikal).

A male and a female, both in the dark phase of plumage, were taken during April 1925 in the mountains of Chingchuan, northern Szechuan. Two more were secured in the poplar forests along the Tao River valley near Choni in March 1926. Both of the latter are in the bicolored phase.

The measurements of all four specimens are small, and do not approach those of *khamensis*.

NUCIFRAGA CARYOCATACTES MACELLA Thayer and Bangs

Nucifraga hemispila macella Thayer and Bangs, Bull. M. C. Z. **62**, 1909, p. 104 (Hsien Shan Hsien, Hupeh, 7000 feet).

This Nutcracker is represented in the collection by two specimens; an adult male in rather worn plumage taken at an elevation of 4,000 feet in the Wutu ho gorges, between Pikou and Kaichow, southern Kansu, April 1925 and an immature male in perfectly fresh plumage, at an elevation of 10,000 feet, in the spruce forests of Drakana, upper Tebbuland in October 1926.

CYANOPICA CYANUS SWINHOEI Hartert

Cyanopica cyanus swinhoei Hartert, Vög. Pal. Faun., **1**, heft 1, 1903, p. 24 (Kiukiang).

Five specimens of both sexes were taken in May, north of Kaichow, southern Kansu, in willow trees along the river; a female was shot along the Tao valley near Choni, also in May 1925, and a fledgling was caught 23 June 1925 in willow trees along the Ba River.

As shown by Kleinschmidt (Abh. u. ber. Zoöl. Mus. Dresden, **15**, 1922, p. 4) this species varies a great deal in the same region. The birds from Kaichow measure: wing 135-146 mm.; tail 212-233 mm.; the Choni bird wing 142 mm.; tail 238 mm.

GARRULUS GLANDARIUS PEKINGENSIS Reichenow

Garrulus bispecularis pekingensis Reichenow, J. f. O., 1905, p. 425 (Peking).

A single specimen, clearly referable to this subspecies, was secured in the valley of Sasuma, below Labrang, at an elevation of 8,000 feet, in December 1925.

GARRULUS GLANDARIUS SINENSIS Swinhoe

Garrulus sinensis Swinhoe, P. Z. S., 1871, p. 381 (south China westwards to Szechuan).

A male and a female from the juniper forests of Pezlu, 7,200 feet, upper Tebbuland, September 1926; a male and a female, forests of Wantsang, 6,500 to 8,000 feet, Ha Tebbuland, September 1926.

Both of the first mentioned specimens are birds of the year; the male had nearly completed the post juvenal moult, the female was in a transition stage between the juvenal and immature plumages. The birds from the Ha Tebbu country are in fresh autumn plumage. Both are darker above than usual in examples of *sinensis* from eastern China, but can be exactly matched by a bird in the La Touche collection from northwestern Fokien. Hartert (Vög. Pal. Faun, 3, 1921, p. 2033) has already commented on the occurrence of light and dark examples of *sinensis*. The immature of the European Jay is said to be darker above than the adult, and we are, therefore, inclined to consider the dark examples of *sinensis* as immature.

BOANERGES INTERNIGRANS Thayer and Bangs

Boanerges internigrans Thayer and Bangs, Mem. M. C. Z. 40, 1912, p. 200, pl. 6 (Shoo-O-lo, northern Szechuan, 14,500 feet).

Four examples, all of them females, of this rare Jay were secured. In June 1925 two adults in worn summer dress and a fully grown juvenal were collected in the spruce forests at 10,000 feet elevation in that part of the Tebbu country lying south of the Minshans, and an example in fresh immature plumage was taken in fir and rhododendron forests of Ha Tebbuland at an elevation of 10,000 feet in September 1926.

The characters on which this genus is based appear to us to be sufficiently trenchant to warrant its retention, and we, therefore, have not "lumped" *Boanerges* with *Perisoreus*, as has been done by Hartert and others.

PYRRHOCORAX PYRRHOCORAX HIMALAYANUS (Gould)

Fregilus himalayanus Gould, P. Z. S., 1862, p. 125 (Himalayas).

Choughs were common along the Tao valley near Choni, where a male and a female were taken in May 1925. A female was secured in eastern Kokonor near Mochur nira, a large pass between Ark'tsa and Dachso canyon at 12,000 feet altitude, 1 June 1926, and another female 4 June 1926 in the Waro valley, north of Radja.

All of the specimens listed agree with Kleinschmidt and Weigold's characterization of this race, and we agree with them that *himalayanus* is a perfectly recognizable form.

PODOCES HUMILIS Hume

Podoces humilis Hume, Ibis, 1871, p. 408 (Sanju Pass).

Of the nine specimens taken none were in fresh unworn plumage. Apparently abrasion takes place very quickly in this species.

Two females were collected, 31 May 1925, near Old Tao Chow, where the birds were found frequenting meadows and loess ditches; five males and a female were taken during September 1925 on the grasslands about Lake Kokonor and an adult female in very badly worn plumage was shot on the Ba plain, 10,500 feet, south of the Jupar range, 24 June 1926.

Rock's notes state that "this bird has a peculiar habit of bowing his head with a jerk several times after alighting."

We have not been able to make comparison with topotypical examples from Turkestan.

EXPLANATION OF PLATES.

PLATE 1.

PLATE 1.

A

Kansu, Laliku. The backbone of the Minshan range, as seen from the top of Laliku ridge. Elevation 12,000 feet. Oct. 18, 1926.

B

Kansu, Babo. The valley of the Kanchow ho beyond its confluence with the Hei ho. Looking upstream. To the left is the peculiar volcano-like mountain at the foot of which is situated the village of Huan fantassu. In the center is Nginsin shan (Bullock Mountain). To the right is the valley of the Hei ho, elevation 9000 feet. Looking southeast. Oct. 18, 1925.



A



B

PLATE 2.

PLATE 2.

A

Kansu, Arketassu. Looking across the valley of the Babo ho, near the tent lamasery of Arketassu, towards the north Kokonor Barrier range. Babo district. Oct 16, 1925.

B

Kansu, Babo. The Babo ho looking upstream near the junction of the Arketassu ho and the Babo ho at the foot of Nginsin shan (Bullock Mountain). Spruces cover the hillsides. Oct. 16, 1925.



A



B

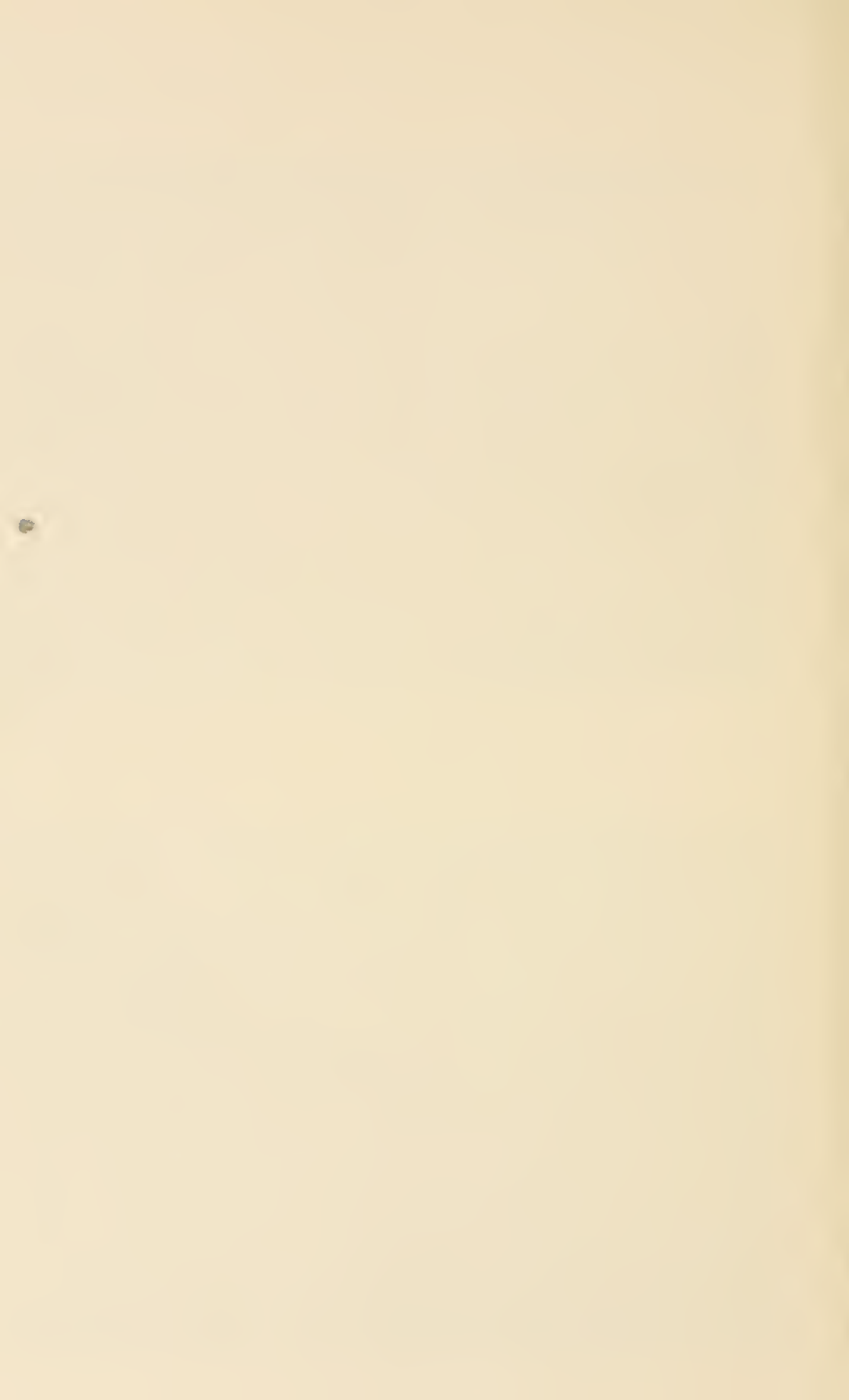


PLATE 3.

PLATE 3.

A

Tibet, Jupar valley, looking up the Jupar valley on the northern slopes of the Jupar range from a bluff opposite the camp, elevation 11,300 feet. Showing the spruce forest, the only region in which the Jupar range is forested. The triangular peak in the center of the valley is Jupar shimying, said to be the second highest peak of the Jupar range. June 28, 1926.

B

Tibet, Ba valley. View of the Ba valley from its southern rim in the Ba plain, elevation 10,400 feet. Looking north and showing the willow-lined Ba stream and the eroded loess and gravel slopes of the valley. On the terraces in the valley are visible the only two Tibetan villages for many days' journey, called Saoch rongwo meaning: "The people living under the ground," a name given them by the nomads who would never live in a house. This settlement is only six years old. In the distance are visible the southern slopes of the Jupar range, which are absolutely bare. July 3, 1926.



A



B

PLATE 4.

PLATE 4.

A

Tibet, H'tchachen valley, The Hwang ho (Yellow River) looking upstream from a bluff above it and west of it. Northwest of H'tchachen valley. Elevation 10,500 feet. July 17, 1926.

B

Tibet, Drakana. In the limestone amphitheatre of Drakana, upper Tebbu-land. Looking down from a meadow, the camping place, to the village of Towa and the Lamasery of Lassungomba above it. It is one of the finest scenic spots of the whole Tebbu country. Aug. 30, 1926. Elevation 9,700 feet.



A



B

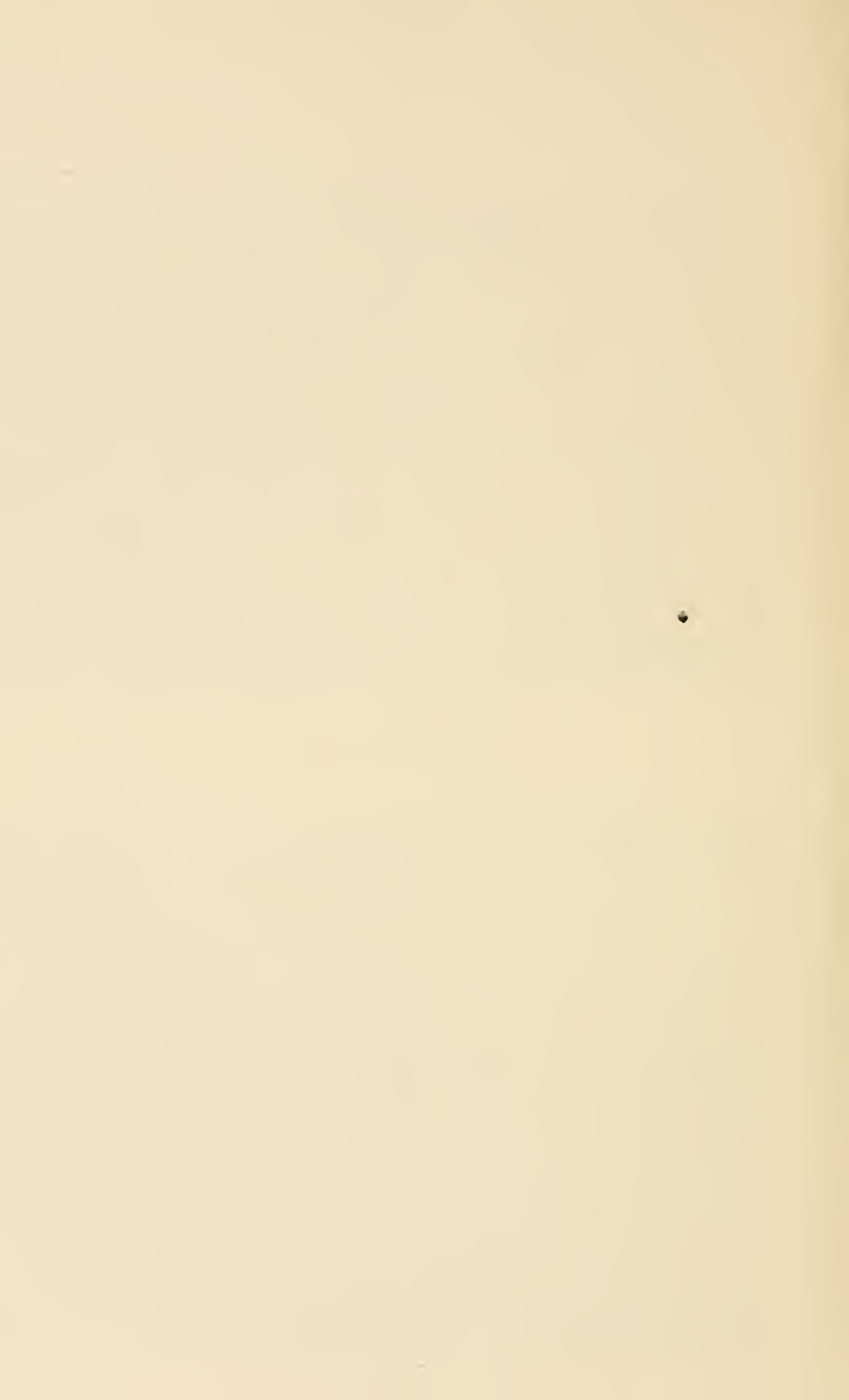


PLATE 5.

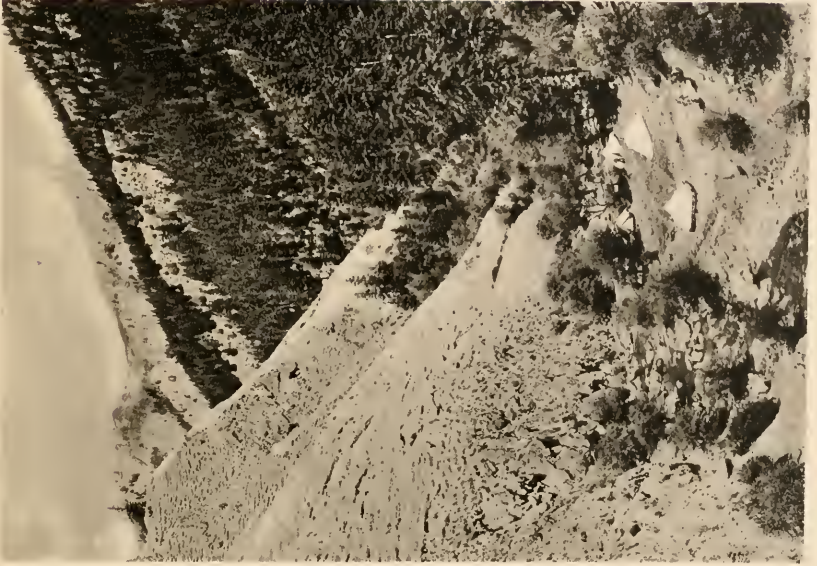
PLATE 5.

A

Tibet, Wantsang Ku. Forests of *Abies* and *Picea* in Wantsang Ku (valley). Lower Tebbu country. Sept. 12, 1926.

B

Tibet, Dachso. Looking down on to the camp in Dachso canyon, among spruces, birches, and willows, from the trail leading to Ngarki Ngongina bluff. Elevation of camp, 10,146 feet. June 2, 1926.



B



A



Bulletin of the Museum of Comparative Zoölogy

AT HARVARD COLLEGE.

VOL. LXVIII. No. 8.

A COLLECTION OF BIRDS FROM OAXACA.

BY OUTRAM BANGS AND JAMES L. PETERS.

CAMBRIDGE, MASS., U. S. A.:

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OCTOBER, 1928.

No. 8. — *A Collection of Birds from Oaxaca.*

BY OUTRAM BANGS AND JAMES L. PETERS.

IN the early part of 1927, Col. John E. Thayer sent Mr. Wilmot W. Brown into the state of Oaxaca, Mexico to try and obtain specimens of the very rare tyrant flycatcher *Deltarhynchus flammulatus* (Lawr.) for the collections of the Museum of Comparative Zoölogy.

Brown first made his headquarters at a ranch house near Chivela, a point on the railroad about forty miles inland from Salina Cruz, and at an elevation of 600 feet above sea level. He collected there from 15 February to 7 June, and while he did not find the chief object of his trip, he made a good representative collection of birds of the region, all beautifully prepared. Between 29 April and 5 May he collected a few birds at Lagunas and Almoloya, places which we cannot locate on any map available to us, but which are apparently very close to Chivela.

He then went to Tapanatepec, a small town in southern Oaxaca, not shown on any maps that we have seen, but located near Chahuities, a station on the National Railway of Mexico, near the Chiapas border. Here he collected from 6 July to 12 November. Writing under date of 10 August Mr. Brown says: "We are now located at Tapanatepec, which is three hours' horseback ride from what was formerly known as the Cacoprieto Ranch, where Sumichrast took *Deltarhynchus* in 1872. The ranch is no longer in existence, and there is nothing left of the ranch house where Sumichrast lived when he did his collecting; therefore I have labelled all my specimens Tapanatepec.¹ It is very difficult to collect in the vicinity of Cacoprieto for one has to return to town every night on account of the bandits with whom the region has been infested for many years. . . ."

In spite of the hazards of collecting in such a district, Brown took over 300 birds, including eight examples of *Deltarhynchus*, more than all the previously known specimens of that species combined.

From Chivela to Chahuities is about seventy-five miles in a straight line, but between those two points there is a slight break in the fauna, several of the species occurring about Chivela being subspecifically different from the form found at Tapanatepec, for example: *Xiphorhynchus flavigaster flavigaster*, *Tyrannus melancholicus chloronotus* and

¹ Nevertheless some specimens were labelled Cacoprieto and where this was done we have so recorded them. *Authors.*

Colinus virginianus coyolcos at Tapanatepec were replaced at Chivela by *X. f. megarrhynchus*, *T. m. occidentalis* and a form of *Colinus virginianus* that we describe as new.

The climate at Chivela is evidently less humid than at Tapanatepec, since several species usually considered characteristic of a dry climate were taken at the former place, but not at the latter. Such species are: *Burhinus bistriatus bistriatus*, *Gecococcyx affinis*, *Heleodytes zonatus*, *Eremophila alpestris oaxacae* and *Passerina rositae*.

At Chivela Brown collected some characteristic birds of the "Pine Ridge," but apparently made no attempt to get into the pines near Tapanatepec (if indeed there were any within a reasonable distance.)

CRACIDAE

ORTALIS POLIOCEPHALA (Wagler)

One male; Chivela; March 25, 1927.

ODONTOPHORIDAE

COLINUS VIRGINIANUS COYOLCOS (P. L. S. Müller)

One adult male; Tapanatepec; August 3, 1927.

COLINUS VIRGINIANUS THAYERI subsp. nov.¹

Fifteen specimens, eight males and seven females; all from Chivela; March April and May, 1927.

Type.— From Chivela, Oaxaca, Mexico, adult ♂ M. C. Z. 238,200. Collected March 29, 1927 by W. W. Brown.

Characters.— Adult male, similar to the adult male of *C. v. coyolcos*, but with white throat and white superciliaries, the throat sometimes streaked with black; above paler and less spotted, the feather edgings grayer. Similar also to *C. v. pectoralis* (Gould), but black breast band broader, with less or no white at the base of the feathers of this region. The broad pectoral band at once separates this form from *C. v. graysoni*.

The females are much more variable than the males and are very similar to the corresponding sex of *coyolcos*.

¹ Named for Colonel John E. Thayer, in recognition of his services to ornithology.

CYRTONYX OCELLATUS (Gould)

One adult male, Tapanatepec; July 10, 1927. Taken at 1,200 feet altitude.

COLUMBIDAE

COLUMBA FLAVIROSTRIS FLAVIROSTRIS Wagler

One female; Chivela; March 25, 1927.

MELOPELIA ASIATICA ASIATICA (Linné)

One female; Chivela; February 28, 1927.

SCARDAFELLA INCA INCA (Lesson)

Two males; Chivela; February 27 and March 15, 1927.

LEPTOTILA FULVIVENTRIS ANGELICA Bangs and Penard

One male; Amloloya; May 3, 1927.

CHARADRIIDAE

PLUVIALIS DOMINICUS DOMINICUS (P. L. S. Müller)

Three specimens, one male and two females; Chivela; March 27, 29 and 30, 1927.

SCOLOPACIDAE

TRINGA SOLITARIA SOLITARIA Wilson

One male; Tapanatepec; August 15, 1927.

BURHINIDAE

BURHINUS BISTRIATUS BISTRIATUS (Wagler)

Two females; Chivela; March 22 and April 9, 1927.

FALCONIDAE

MICRASTUR SEMITORQUATUS PERCONTATOR (Cabot)

One immature female; Tapanatepec; August 15, 1927.

ASTURINA NITIDA PLAGIATA Schlegel

Three specimens, both sexes, all adult; Chivela; April 5. Tapanatepec; August 27 and August 29, 1927.

URUBITINGA URUBITINGA RIDGWAYI Gurney

One adult male; Chivela; April 15, 1927.

BUBONIDAE

CICCABA VIRGATA VIRGATA (Cassin)

One adult male; Chivela; May 14, 1927.

GLAUCIDIUM BRASILIANUM RIDGWAYI Sharpe

Four specimens, both sexes; Chivela; March. Tapanatepec; September 25, 1927.

PSITTACIDAE.

ARATINGA HOLOCHLORA (Sclater)

Four specimens, both sexes; Tapanatepec; August and September, 1927.

ARATINGA STRENUA (Ridgw.)

Two males; Tapanatepec; September, 1927.

This species, originally described as a subspecies of *A. holochlora*, has hitherto been believed to be the form of that species occurring in western Central America from Salvador to Nicaragua. Since both *holochlora* and *strenua*, however, were collected by Brown at the same locality and as the feet and bill of the latter bird are decidedly larger and heavier they should be regarded as specifically distinct. *Aratinga brevipes* (Lawr.) from Socorro Island agrees with *strenua* in having large feet and bill, and is probably derived from that species rather than from *holochlora*. *Brevipes* we also regard as a distinct species by reason of its different primary formula.

ARATINGA CANICULARIS CANICULARIS (Linné)

Ten specimens, both sexes; Chivela and Tapanatepec; February, March, April, August and September, 1927.

This species is easily divided into two recognizable races; one, occupying the Pacific slope from the Isthmus of Tehuantepec to western Costa

Rica, having a much wider frontal band which extends back on the crown to at least on a line with the anterior border of the eye and downwards to the upper half of the lores, and with the underparts much more yellowish; the other occurring on the west coast of Mexico from Mazatlan and Sinaloa south at least to Guerrero, distinguished by having a narrow frontal band and more greenish underparts. For the former we use the name *Aratinga canicularis canicularis* (Linné) and for the latter *A. canicularis eburnirostrum* Lesson.

Psittacus canicularis Linné, 1758, p. 98 is a composite species, but the principal reference is to Edward's Red and Blue-headed Parrakeet (Nat. Hist. Bds., p. 176, pl. 176). Description and plate are both excellent, and beyond a doubt the specimen Edwards figured and described from Lady Wager's collection as coming from the West Indies is the form with the wide frontal bands that ranges from the Isthmus of Tehuantepec to Costa Rica, We therefore designate northwestern Costa Rica as the type locality.

We were quite unable to determine to which form *Sittace petzii* Wagler ("Mexico") might apply, but learning that the type was in the ornithological collection of the Zoologische Sammlung des Bayerischen Staates in Munich, we wrote to Dr. A. Laubmann, the Konservator für Ornithologie, giving the differences between the northern and southern forms and asked him if he could tell us to which race the type belonged. He, with great kindness, replied saying that the type and only specimen was labelled merely "Mexico," but enclosed a colored sketch of the head, made by Frau Laubmann. This sketch has enabled us to decide definitely that *Sittace petzii* is a synonym of *Psittacus canicularis*.

We fail to see how *Aratinga* and *Eupsittula* can be maintained as distinct genera; the characters on which the two genera rest grade into one another through intermediate species, and no line can be drawn between them.

BROTOGERYS JUGULARIS JUGULARIS (P. L. S. Müller)

Eleven specimens, both sexes; Tapanatepec; August, 1927.

AMAZONA ALBIFRONS ALBIFRONS (Sparrmann)

Three specimens, both sexes; Chivela; April 9, 10 and 11, 1927.

ALCEDINIDAE

CHLOROCERYLE AMAZONA (Latham)

One adult female; Almoloya; May 1, 1927.

MOMOTIDAE

MOMOTUS MOMOTA GOLDMANI Nelson

One adult male; Chivela; March 9, 1927.

MOMOTUS MEXICANUS MEXICANUS Swainson

Thirteen specimens, adult, immature and juvenal; Chivela, Almoloya and Tapanatepec; February, March, May, July and August, 1927.

We are wholly unable to distinguish *Momotus mexicanus mexicanus* and *M. m. saturatus* Nelson (Auk, **14**, 1897, p. 49, Ciudad, Tehuantepec); specimens in the M. C. Z. collection from either Sinaloa or Oaxaca can be matched exactly both as to color and size in a series of nearly fifty examples from Colima.

CAPRIMULGIDAE

CHORDEILES ACUTIPENNIS MICROMERIS Oberholser

Four males; Chivela; May and June, 1927.

NYCTIDROMUS ALBICOLLIS NELSONI Ridgway

Five specimens, including one juvenal; Chivela; May. Tapanatepec; July, 1927.

The three adults in this series, although we record them as *nelsoni*, are really intermediate between *nelsoni* and *sumichrasti*, but perhaps a little nearer the former. In any event the distinctions between the two races are very finely drawn, and they could be combined without any great distortion of the facts.

TROCHILIDAE

AMIZILIS RUTILA RUTILA Delattre

Three specimens, both sexes; Tapanatepec; July, August and October, 1927.

AMIZILIS CYANOCEPHALA CYANOCEPHALA (Lesson)

One adult female; Chivela; June 3, 1927.

CYNANTHUS DOUBLEDAYI (Bourcier)

Two adults, male and female; Chivela; April and May.

ANTHRACOTHORAX PREVOSTII PREVOSTII (Lesson)

One adult male; Tapanatepec; October 1, 1927.

ANTHOSCENUS CONSTANTII LEOCADIAE (Bourcier and Mulsant)

One adult male; Lagunas; April 29, 1927.

TROGONIDAE

TROGON CITREOLUS Gould

Seven adult specimens, both sexes; Chivela; March and April, 1927.

CUCULIDAE

COCCYZUS AMERICANUS OCCIDENTALIS Ridgway

One adult male; Tapanatepec; October 1, 1927.

PIAYA CAYANA THERMOPHILA Sclater

Two adults, male and female; Chivela; April 11. Tapanatepec; November 3, 1927.

GEOCOCCYX AFFINIS Hartlaub

Two adult females; Chivela; March 25 and April 29, 1927.

MOROCCOCCYX ERYTHROPYGUS MEXICANUS Ridgway

Eight adults, both sexes; Chivela and Tapanatepec; March and August, 1927.

CROTOPHAGA SULCIROSTRIS SULCIROSTRIS Swainson

Four adults, both sexes; Chivela and Tapanatepec; April and August.

RAMPHASTIDAE

PTEROGLOSSUS TORQUATUS TORQUATUS (Gmelin)

One adult female; Tapanatepec; October 31, 1927.

PICIDAE

BALANOSPHYRA FORMICIVORUS FORMICIVORUS (Swainson)

One female; Chivela; June 6, 1927.

CENTURUS SANTACRUZI POLYGRAMMUS Cabanis

Three specimens, both sexes; Chivela; March, 1927.

Ridgway (Bds. No. and Mid. Am., 6, 1914, p. 78) rates *polygrammus* as a distinct species, but we do not regard the distinctions between this bird and *santacruzii* as anything more than slight differences of degree, and prefer to reduce this and *frontalis* of Nelson to subspecies of *santacruzii*.

CEOPHLOEUS LINEATUS SIMILIS (Lesson)

Four adult specimens, both sexes; Chivela, Lagunas and Tapanatepec; February, March, April and July.

DENDROCOLAPTIDAE

SITTASOMUS GRISEICAPILLUS SYLVIODES Lafresnaye

One immature male; Tapanatepec; July 11, 1927.

This specimen, although not fully adult, agrees wholly with skins from Vera Cruz that may be considered topotypical *sylvioides*.

Birds from Yucatan and British Honduras, however, are different and represent a hitherto unnamed form that we call

SITTASOMUS GRISEICAPILLUS GRACILEUS subsp. nov.

Type.—From Chichen Itza, Yucatan, adult male, Museum of Comparative Zoölogy 41,067. Collected February 5, 1890, by Pablo Perera.

Characters.—Similar to *S. g. sylvioides* Lafresnaye, but much paler throughout, under parts and crown more grayish, less greenish olive; secondaries, wing edgings, lower back, rump and upper tail-coverts paler rufous. Size decidedly smaller. Males, wing, 70–74; tail, 73–77; bill to base, 16; tarsus, 16–17, two specimens. Female wing, 68–69; tail, 65–69; bill to base, 16–16.5; tarsus, 16, two specimens.

Remarks.—Lafresnaye's type of *Sittasomus sylvioides*, M. C. Z. 77,039 from "Mexico" is, in its present state, too faded to show diagnostic color characters. It is a large bird with a wing of 84 mm., a maximum value for the form of Vera Cruz. Most of Lafresnaye's Mexican birds, however, came from Vera Cruz, and we therefore restrict the type locality of *Sittasomus sylvioides* Lafresnaye to State of Vera Cruz, Mexico, a course in accord with the facts as far as can be determined, and one which involves no change in established nomenclature.

XIPHORHYNCHUS FLAVIGASTER FLAVIGASTER Swainson

One adult male; Tapanatepec; July 9, 1927.

This skin is strictly referable here, while those collected at Chivela belong to the following subspecies. A female from Santa Efigenia,

Oaxaca, taken December 17, 1868 by Prof. Sumichrast is also typical of *X. f. flavigaster* in every respect.

XIPHORHYNCHUS FLAVIGASTER MEGARHYNCHUS (Nelson)

Three adult males; Chivela; April and May.

These examples, while not typical of *megarhynchus*, having a shorter wing and slightly shorter bill, nevertheless agree with that race in paler coloration, dark edging of the throat feathers, and above all in the stout bill.

Among the birds collected for Mr. Brewster in Chihuahua by Frazar is a pair of woodhewers that differ from *X. f. mentalis* (Baird) so strikingly that we do not hesitate to describe the form as

XIPHORHYNCHUS FLAVIGASTER TARDUS subsp. nov.

Type.—Museum of Comparative Zoölogy 224,029, from Hacienda de San Rafael, Chihuahua, collected 7 May 1888 by M. Abbott Frazar.

Characters.—Similar to *X. f. mentalis* (Baird) but much smaller; paler both above and below, especially the lower back and posterior underparts.

Measurements

No.	sex	wing	tail	bill	tarsus
224,029 (type)	♂	109	102	41	25
224,030	♀	105	93	40	25

We have made comparison with a series of eighteen specimens of *mentalis* (including the type) kindly lent to us by the United States National Museum as well as with a good series of *flavigaster* from Tamaulipas and Vera Cruz from the Museum of Comparative Zoölogy collection. Mr. Brewster suspected the distinctness of his Chihuahua specimens years ago and compared them with the type of *mentalis*, noting the differences on a slip of paper which has remained with the birds ever since.

TYRANNIDAE

TOLMOMYIAS SULPHURESCENS CINEREICEPS (Sclater)

Sixteen specimens, adults and immature of both sexes; Tapanatepec; July, August, September, October and November, 1927.

MYIOPAGIS VIRIDICATA PLACENS (Sclater)

One adult male; Tapanatepec; November 3, 1927.

CAMPTOSTOMA IMBERBE Sclater

Two adult females; Chivela; May 31. Tapanatepec; October 27, 1927.

MYIOZETETES SIMILIS TEXENSIS Giraud

Fourteen specimens, both sexes; Chivela; April and May. Tapanatepec; July, August, September and October, 1927.

PITANGUS SULPHURATUS DERBIANUS (Kaup)

Eight specimens, adults of both sexes and one imature; Chivela; March and April. Tapanatepec; July, August, September and November, 1927.

MYIODYNASTES LUTEIVENTRIS LUTEIVENTRIS Sclater

Seven specimens, both sexes, all adult; Tapanatepec; July, August, September and October.

These birds agree with examples from Vera Cruz and southward rather than with specimens of *swarthy* (Van Rossem, Condor, **29**, 1927, p. 126, Huachuca Mts., Arizona).

The latter race extends southward into Chihuahua from where we have skins from Carmen, Bravo, and Hacienda de San Rafael. *Swarthy* is extremely close to typical *luteiventris* and to appreciate the distinctions, it is necessary to examine series of each race in comparable plumages.

MEGARHYNCHUS PITANGUA MEXICANUS (Lafresnaye)

Ten adults, both sexes; Chivela; March, April and May. Tapanatepec; July, August and September, 1927.

ONYCHORHYNCHUS MEXICANUS MEXICANUS Sclater

One adult male; Cacoprieto; July 8, 1927.

SAYORNIS PHOEBE (Latham)

One female; Tapanatepec; November 7, 1927.

EMPIDONAX TRAILLII TRAILLII (Audubon)

Five specimens, both sexes; Chivela; May 14 and 15. Tapanatepec; August 14 and 25, and September 9, 1927.

EMPIDONAX TRAILLII BREWSTERI Oberholser

Two males; Chivela; May 20. Almoloya; May 3, 1927.

EMPIDONAX MINIMUS (Baird)

Sixteen specimens, both sexes; Chivela and Almoloya; February, March and May. Tapanatepec; August, September and October, 1927.

EMPIDONAX FLAVIVENTRIS (Baird)

Three specimens, both sexes; Chivela and Almoloya; May. Tapanatepec; September 29, 1927.

EMPIDONAX WRIGHTII (Baird)

Five specimens, both sexes; Chivela; February 15. Tapanatepec; October and November, 1927.

MYIOCHANES RICHARDSONII SORDIDULUS (Sclater)

Eight specimens, both sexes; Chivela; May. Cacoprieto and Tapanatepec; July, August and September, 1927.

MYIARCHUS CRINITUS (Linné)

Six specimens, both sexes; Tapanatepec; September and October.

MYIARCHUS CINERASCENS CINERASCENS Lawrence

Six specimens, both sexes; Chivela; February and March. Tapanatepec; October and November.

MYIARCHUS NUTTINGI NUTTINGI Ridgway

Twenty-three specimens, both sexes; Chivela; February, March, April and May. Tapanatepec; July, August, September and October, 1927.

Myiarchus nuttingi iniquitus Salvin and Godman seems to us to be a rather poorly marked form, differing from *M. n. nuttingi* chiefly in being slightly paler below, with the posterior edge of the gray chest less sharply defined. The amount of dusky edgings on the inner webs of the tail feathers next to the shaft is a variable quantity and seems not to be a good diagnostic character.

MYIARCHUS TYRANNULUS NELSONI Ridgway

Thirty-six specimens, both sexes; Tapanatepec; September 1 to November 10, 1927.

All but two of this series are wholly referable to *nelsoni*; two are intermediate but are a trifle closer to this form than to *magister*.

MYIARCHUS TYRANNULUS MAGISTER Ridgway

Four specimens, both sexes; Chivela; March 8, April 7, June 1. Tapanatepec; November 11.

The latter example is intermediate between this race and *nelsoni*, though nearer, we think, to *magister*.

MYIARCHUS TUBERCULIFER LAWRENCEI (Giraud)

Two males; Tapanatepec; September 20 and 27, 1927.

DELTARHYNCHUS FLAMMULATUS (Lawrence)

Eight specimens; Tapanatepec and Cacoprieto; September, October and November, 1927. Six of these are adults of both sexes. Two, September 5 and 10, are changing from juvenal to immature plumage.

Before Brown secured this series, this very scarce bird was known by only six specimens.

Mr. Brown was unable to give us anything on the habits of this species. He did say, however, that of all the rare birds he had been especially sent to secure, this one was perhaps the most difficult.

TYRANNUS CRASSIROSTRIS CRASSIROSTRIS Swainson

Two adults, male and female; Tapanatepec; October 3 and November 12, 1927.

Swainson's *Tyrannus crassirostris* (Quart. Journ. Sci. Litt. and Arts. Roy. Inst. 20, no. 4, 1826, p. 273) was described as "inhabiting the warm districts of Mexico." This locality is too indefinite, so we restrict it to Acapulco, State of Guerrero, Mexico, as being a place entirely within the realm of the probable origin of Swainson's type. This species has never been recorded north of Sinaloa. There are, however, in the Brewster collection three examples from Alamos, Sonora, and five from the Hacienda de San Rafael, Chihuahua, that represent a well marked northern race that we name

TYRANNUS CRASSIROSTRIS POMPALIS subsp. nov.

Type.—From Hacienda de San Rafael, Chihuahua, adult male, Museum of Comparative Zoölogy 223,593; collected 7 May, 1888 by M. A. Frazar.

Characters.—Similar to *T. c. crassirostris* Swainson but paler; more grayish, less olive above; yellow of under wing coverts and underparts much paler, more sulphur less lemon yellow.

Specimens examined

T. c. crassirostris. Sinaloa: Escuinapa 1 ♂: Oaxaca: Tapanatepec 1 ♂ ? 1 ♀.

T. c. pompalis. Sonora: Alamos, 2 ♂, 1 ♀; Chihuahua: Hacienda de San Rafael, 3 ♂, 2 ♀.

TYRANNUS MELANCHOLICUS CHLORONOTUS Berlepsch

Four adult specimens, both sexes; Tapanatepec; July, August and September.

TYRANNUS MELANCHOLICUS OCCIDENTALIS Hartert and Goodson

Five adults, both sexes; Chivela; March, April and May.

The state of Oaxaca seems to be the meeting ground of the two races of *melancholicus* listed here. All four specimens from Tapanatepec are clearly referable to *chloronotus*. Those from Chivela, on the other hand, come much nearer to *occidentalis*, three of the five specimens being that form; the other two are intermediate but nearer *occidentalis*.

MUSCIVORA FORFICATA (Gmelin)

One female; Tapanatepec; October 25, 1927.

PIPRIDAE

CHIROPRION LINEARIS LINEARIS (Bonaparte)

Four specimens, one adult male, two immature males, and one adult female; Chivela; May. Tapanatepec, July and October.

Ridgway (Bds. No. and Mid. Am., pt. 4, 1907, p. 740, note) points out that adult males of the long-tailed Manakin from Mexico and Guatemala have shorter middle rectrices than those from Costa Rica and Nicaragua, and generally a larger and relatively wider bill. He did not however recognize any subspecies, since the structural differences were not accompanied by color characters. The structural differences pointed out by Ridgway are constant in the large series that we have examined, so we recognize two forms that stand

CHIROPRION LINEARIS LINEARIS (Bonap.) "Mexico"

Southern Mexico to Guatemala.

CHIROPRION LINEARIS FASTUOSA (Less.) Realejo, Nicaragua

Nicaragua and Costa Rica.

COTINGIDAE

TITYRA SEMIFASCIATA PERSONATA Jardine and Selby

One adult female; Chivela; March 9, 1927.

This skin does not differ in any way from specimens from southeastern Mexico and Guatemala. It shows no approach to *griseiceps*.

PLATYPSARIS AGLAIAE SUMICHRASTI Nelson

Nine specimens, both sexes, including both immature and adult males; Tapanatepec; July, September and October, 1927.

POLIOPTILIDAE

POLIOPTILA NIGRICEPS Baird

Four adults, both sexes; Chivela; March and April. Tapanatepec; August, 1927.

TROGLODYTIDAE

HELEODYTES ZONATUS IMPUDENS subsp. nov.

Type.—238,315 Museum of Comparative Zoölogy adult male from Chivela, Oaxaca (600 feet), collected 2 March, 1927 by W. W. Brown.

Characters.—Similar to *H. z. zonatus* (Less) of southeastern Mexico but much larger; spots below larger and less numerous; flanks rather more heavily barred. Similar also to *H. z. restrictus* Nels. from Tabasco but slightly larger; abdomen paler, flanks less heavily barred and spots not invading the centre of the abdomen.

Measurements.—(Four males) wing 91–95 (93.75); tail 87–96 (92.25); bill from base 23–24.5 (23.9).

Material examined

Helodytes zonatus zonatus (Less) 24, both sexes. Vera Cruz: Jalapa, Motzorongo, Presidio, Paso Nuevo, Orizaba.

H. z. restrictus Nels. 9, both sexes, Tabasco: Frontera; British Honduras: Toledo District; Guatemala Trade Skins.

H. z. impudens nob. 4 ♂, 1 sex not determined, Oaxaca: Chivela, Guichicovi.

HELEODYTES HUMILIS (Sclater)

Nineteen specimens, both sexes; Chivela; April, May and June. Tapanatepec; July, August and November, 1927.

THRYOPHILUS PLEUROSTICTUS PLEUROSTICTUS (Sclater)

Twenty-two specimens, adults of both sexes, and juvenal; Chivela; March, April and May. Lagunas; April and May. Tapanatepec; July and August, 1927.

SALPINCTES OBSOLETUS NOTIUS Ridgway

One male, in much abraded plumage; Cacoprieto; July 6, 1927.

We refer this specimen to *notius*, a form which seems to us very poorly characterized, on geographical grounds.

MIMIDAE

MIMUS POLYGLOTTUS LEUCOPTERUS (Vigors)

One female; Chivela; March 11, 1927.

MIMUS GILVUS LAWRENCEI Ridgway

Two adults, male and female; Chivela; April 5 and March 10, 1927.

TURDIDAE

TURDUS GRAYI GRAYI Bonaparte

Four adult males; Tapanatepec; August and September, 1927.

VIREONIDAE

VIREO FLAVOVIRIDIS FLAVOVIRIDIS (Cassin)

Twenty specimens, both sexes; Chivela; April and May.

On comparing these birds with specimens that had been in the museum for some years, we were at once struck by the very bright olive green of their backs, as against the dull olive green of the older specimens. Further investigation showed that old museum specimens gradually become browner above, the change very gradual but traceable through the dates of the specimens. One bird from the Lafresnaye collection is actually olive brown above, but if the wings are pushed aside the portion of the back covered by them is found to be more as in fresh specimens.

VIREO GILVUS SWAINSONI (Baird)

One male; Chivela; April 2, 1927.

VIREO FLAVIFRONS Vieillot

One male; Tapanatepec; October 27, 1927.

VIREO SOLITARIUS SOLITARIUS (Wilson)

One male; Tapanatepec; November 1, 1927.

VIREO GRISEUS GRISEUS (Boddaert)

One male; Chivela; March 11, 1927.

VIREO BELLII BELLII Audubon

Five specimens, both sexes; Chivela; March. Tapanatepec; September and October, 1927.

CYCLARHIS FLAVIVENTRIS FLAVIVENTRIS Lafresnaye

Two specimens, male and female; Almoloya; May, 1927.

MNIOTILTIDAE

DENDROICA ÆSTIVA RUBIGINOSA (Pallas)

Five specimens, both sexes; Tapanatepec; August 20-31, 1927.

DENDROICA MAGNOLIA (Wilson)

One female; Tapanatepec; November 5, 1927.

DENDROICA CORONATA CORONATA (Linné)

One male; Chivela; March 5, 1927.

DENDROICA GRACIAE DECORA Ridgway

Five specimens, adults of both sexes, and one juvenal; Chivela; June 3-7, 1927.

These birds are not quite typical of *decora*, since the wings average slightly longer and the throats a little bit paler yellow. However they come much closer to *decora* than to *graciae* and we prefer to place them with the former, since there can be no useful purpose served in recognizing by name a third form with slight intermediate characters.

From the small number of juvenals available it appears that the juvenal plumage of *graciae* is browner above, not so gray as in *decora*. The juvenal collected by Mr. Brown agrees with one in the Biological Survey collection taken in the mountains near Tonalá, Chiapas.

OPORORNIS TOLMIEI (Townsend)

One male; Tapanatepec; October 20, 1927.

ICTERIA VIRENS VIRENS (Linné)

Three specimens, two males and a female; Tapanatepec; September, October and November, 1927.

WILSONIA CANADENSIS (Linné)

One female; Tapanatepec; September 21, 1927.

EUTHLYPIS LACHRYMOSA LACHRYMOSA (Cabanis)

Two males; Chivela; May, 1927.

ALAUDIDAE

EREMOPHILA ALPESTRIS OAXACAE (Nelson)

Fourteen adults, both sexes; Chivela; May and June, 1927.

FRINGILLIDAE

HEDYMELES LUDOVICIANUS (Linné)

Three specimens, two males and a female; Tapanatepec; October 19, November 3 and 7, 1927.

CYANOCOMPSA PARELLINA INDIGOTICA Ridgway

Two adult females; Chivela; March and May, 1927.

Todd in his review of the genus *Cyanocompsa* unites *indigotica* with *sumichrasti*, to which procedure we wholly agree. The two females listed above have the wing 70 and 71.5. *Sumichrasti* was supposed by Ridgway to be larger than *indigotica*, but the more ample material now available does not support this.

SPOROPHILA MINUTA PARVA Lawrence

One fine adult male; Tapanatepec; July 14, 1927.

VOLATINIA JACARINI ATRONITENS Todd

Three adult males; Tapanatepec; August, 1927.

SALTATOR ATRICEPS ATRICEPS Lesson

Four adults, both sexes; Almoloya; May 3. Tapanatepec; July, August and September, 1927.

SPINUS NOTATUS NOTATUS Du Bus

One adult female; Chivela; June 6, 1927.

SPIZA AMERICANA (Gmelin)

One female; Chivela; April 22, 1927.

CHONDESTES GRAMMACUS STRIGATUS (Swainson)

Three specimens, male and two females; Chivela; March 21 and 22. Tapanatepec; November 1, 1927.

AIMOPHILA RUFICAUDA LAWRENCII (Salvin and Godman)

Seventeen specimens, adults of both sexes, and one immature; Chivela, Lagunas and Tapanatepec; March, April, May, June, July and August.

AIMOPHILA SUMICHRASTI Lawrence

Three adults, two males and a female; Chivela; May and June, 1927.

AIMOPHILA RUFESCENS RUFESCENS (Swainson)

Three specimens, two adults, male and female, and one juvenal (July 10); Tapanatepec; July, 1927.

AIMOPHILA BOTTERII BOTTERII (Sclater)

Seven specimens, adults of both sexes, and one juvenal (July 6); Chivela, Cacoprieto; May and July.

In addition to the material of this species in the Museum of Comparative Zoölogy we have examined the entire Mexican series, including the type of *Coturniculus mexicanus* Lawr., in the United States National Museum and Biological Survey collections.

While *botterii* has a wide range of individual variation, both in size and color, these differences are in no way correlated with locality; examples from Arizona, Texas and Mexico cannot be distinguished.

SPIZELLA PASSERINA MEXICANA Nelson

Three adult males; Chivela; June, 1927.

PASSERINA CYANEA (Linné)

Seven specimens, both sexes; Chivela; February, March and April; Tapanatepec and Cacoprieto; October and November, 1927.

PASSERINA LECLANCHERI Lafresnaye

Fifteen specimens, both sexes; Chivela, Almoloya, Cacoprieto and Tapanatepec; March, April, May and July, 1927.

PASSERINA ROSITAE (Lawrence)

Twenty-three adults, both sexes; Chivela; March, April and May.

THRAUPIDAE

TANAGRA AFFINIS Lesson

Two adults, male and female; Chivela and Tapanatepec; June and July.

PIRANGA RUBRA RUBRA (Linné)

Two specimens, male and female; Tapanatepec; October and November, 1927.

PIRANGA HEPATICA HEPATICA Swainson

Four specimens, both sexes; Chivela; June, 1927.

All four were taken in the pines at about 1,000 feet altitude.

ICTERIDAE

CASSICULUS MELANICTERUS (Bonaparte)

Twelve specimens, both sexes; Chivela, Almoloya, and Tapanatepec; May, June, July, September, October and November.

TANGAVIUS AENEUS ASSIMILIS (Nelson)

Five specimens, adults of both sexes and one juvenal; Chivela and Tapanatepec; April and August, 1927.

STURNELLA MAGNA MEXICANA Sclater

Seven specimens, both sexes; Chivela; March and April.

ICTERUS SPURIUS (Linné)

Eight specimens, both sexes; Chivela; March. Tapanatepec; September, October and November, 1927.

ICTERUS MELANOCEPHALUS MELANOCEPHALUS (Wagler)

Four specimens, both sexes; Chivela; March and April and May, 1927.

ICTERUS GULARIS GULARIS (Wagler)

Twelve specimens, adults of both sexes and immature; Chivela and Tapanatepec; February, March, April, May, July and October, 1927.

ICTERUS SCLATERI SCLATERI Cassin

Eighteen specimens, both sexes; Chivela and Tapanatepec; March, April, May, July, August, September and October, 1927.

ICTERUS PECTORALIS PECTORALIS (Wagler)

Three specimens, two males and a female; Tapanatepec, August and September.

MEGAQUISCALUS MAJOR MACROURUS (Swainson)

One adult male; Chivela; May 15, 1927.

CORVIDAE

CALOCITTA FORMOSA FORMOSA (Swainson)

Eight adults, both sexes, Chivela and Tapanatepec; March, October and November, 1927.

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